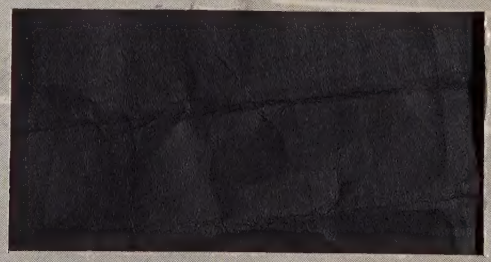
# Instruction Manual



FLUKE®

JOHN FLUKE mfg. co., inc.

SEATTLE WASHINGTON

JOHN FLUKE MFG. CO., INC.
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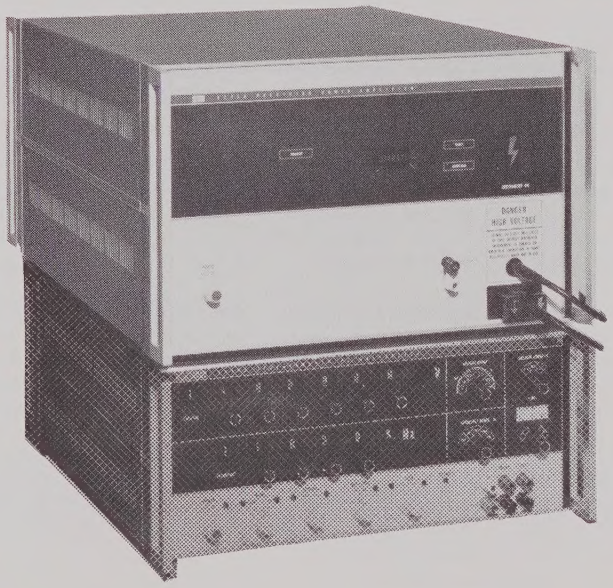

MODEL

# 5215A

PRECISION POWER
AMPLIFIER

JULY 1976
P/N 440131

# WARRANTY

The JOHN FLUKE MFG. CO., INC.* warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify the John Fluke Mfg. Co., Inc.,* giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate will be made before the work begins, provided the instrument is not covered by the Warranty.

"The foregoing warranty is in lieu of all other warranties, express or implied, including but not limited to, any implied warranty of merchantability, fitness or adequacy for any particular purpose or use. Fluke shall not be liable for any special, incident or consequential damages."

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All shipments of John Fluke Mfg. Co., Inc.* instruments should be made via United Parcel Service or "Best Way"** prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

**CLAIM FOR DAMAGE IN SHIPMENT**

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc.* Upon receipt of this report, you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc.* will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to: JOHN FLUKE MFG. CO., INC., P.O. Box 43210, MOUNTLAKE TERRACE, WASHINGTON 98043*.

* For European customers: FLUKE (Nederland) B.V.
Ledeboerstraat 27
Tilburg, Netherlands

** For European customers, Air Freight prepaid.

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Mississauga, Ontario
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TWX: 610-492-2119

Rev. 11/75

# CERTIFICATE of CALIBRATION

The John Fluke Mfg. Co., Inc. hereby certifies that this instrument meets or exceeds all published specifications and has been calibrated using standards whose accuracies are traceable to the National Bureau of Standards within the limitations of the Bureau's calibration services, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration techniques.

Applicable NBS Test Reports:

DC Voltage – 213385

AC Voltage – 212126 & 807675

Resistance – 210508

John F. Holloran

STANDARDS ENGINEER

D. J. Peterson

MANAGER QUALITY ASSURANCE

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MOUNTLAKE TERRACE, WASHINGTON 98043

Attn: Customer Service Dept.

## FLUKE WARRANTY VALIDATION FORM

To assure validation of your warranty, please complete this form and return to John Fluke Mfg. Co., Inc.

MODEL_____ SERIAL NUMBER_____ PURCHASE DATE_____

What influenced you to buy this Fluke product? ☐ Advertising ☐ Contact by local salesman ☐ Other (specify)_____

Have you had previous experience with Fluke instruments? ☐ Yes ☐ No

Did you buy this Fluke product to: ☐ Replace existing equipment ☐ Expand your instrumentation capability

Other (specify)_____

Did you examine comparable products manufactured by other companies before deciding on Fluke? ☐ Yes ☐ No

When you received your instrument, was it in good physical condition? ☐ Yes ☐ No

Did it perform properly on initial operation? ☐ Yes ☐ No

If no, what symptoms were present?_____

Have you owned or used Fluke products prior to this purchase? ☐ Yes ☐ No If yes, how do you rate Fluke products?

| | Poor | Adequate | Superior | | Poor | Adequate | Superior |
|---|---|---|---|---|---|---|---|
| Performance | ☐ | ☐ | ☐ | Useability | ☐ | ☐ | ☐ |
| Reliability | ☐ | ☐ | ☐ | Serviceability | ☐ | ☐ | ☐ |

NAME_____ COMPANY_____

YOUR COMPANY'S PRODUCT OR SERVICE_____

STREET_____ CITY_____ STATE_____ ZIP_____ COUNTRY_____

(If outside US)

Form No. A773 - Rev. 1/76

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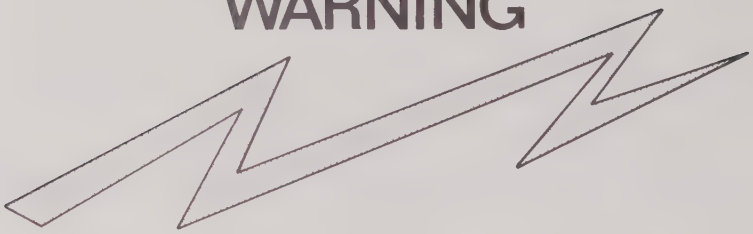
# WARNING



# HIGH VOLTAGE

is used in the operation of this equipment

# DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on the instrument unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections for the line power ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

Greater than 500 volts exist in the following assemblies

POWER SUPPLY
PREAMPLIFIER
POWER AMPLIFIER
OUTPUT TERMINALS

*Warning:* **Potentials less than 500 volts may cause death under certain conditions; Therefore, reasonable precautions should be taken at all times!**

# FIRST AID FOR ELECTRIC SHOCK

## RESCUE

**FREE VICTIM FROM CONTACT WITH LIVE CONDUCTOR QUICKLY.**
**AVOID CONTACT WITH EITHER LIVE CONDUCTOR OR VICTIM'S BODY.**

Shut off high voltage at once and ground circuit. If high voltage cannot be turned off quickly, ground circuit.

An ax with a dry wooden handle may be used to cut high voltage line. Use extreme caution to avoid resulting electric flash.

If circuit cannot be broken or grounded, use a dry board, dry clothing, or other nonconductor to free the victim.

## SYMPTOMS

**NEVER ACCEPT ORDINARY AND GENERAL TESTS FOR DEATH.**

Symptoms of electric shock may include unconsciousness, failure to breathe, absense of pulse, pallor, and stiffness, as well as severe burns. WHENEVER VICTIM IS NOT BREATHING PROPERLY, GIVE ARTIFICIAL RESPIRATION

## TREATMENT

**START ARTIFICAL RESPIRATION IMMEDIATELY.**

Perform artificial respiration at scene of accident, unless victim's or operator's life is endangered. IN THIS CASE ONLY, remove victim to safe location nearby. If new location is more than a few feet away, give artificial respiration while victim is being moved.

After starting artificial respiration, continue without loss of rhythm for at least FOUR HOURS, or until victim is breathing without help. If you have to change operators while giving artificial respiration, do so without losing rhythm of respiration.

## AFTER VICTIM REVIVES

Be prepared to resume artificial respiration, as he may stop breathing again.

When victim is COMPLETELY CONSCIOUS, give him a stimulant (NOT AN ALCOHOLIC DRINK) such as a teaspoonful of aromatic spirits of ammonia in a small glass of water, hot coffee, or hot tea.

Keep victim warm and lying down until he has been conscious for at least fifteen minutes.

## POSITION VICTIM

Place victim in face–upward position and kneel close to his ear.

## CLEAR THROAT

Turn head to one side and quickly wipe out any fluid, mucus, or foreign body from mouth and throat with fingers.

## OPEN AIR PASSAGE

Tilt head back and extend neck to open air passage.

## LIFT JAW FORWARD

Place thumb in victim's mouth and grasp jaw firmly. Lift jaw forward to pull tongue out of air passage. Do not attempt to hold or depress tongue.

## PINCH NOSTRILS CLOSED

With other hand pinch nostrils closed to prevent air leak.

## FORM TIGHT SEAL WITH LIPS

Rescuer's wide–open mouth completely surrounds and seals open mouth of victim. This is not a kissing or puckered position ––mouth of rescuer must be wide–open.

## BLOW

Exhale firmly into victim's mouth until chest is seen to lift. This can be seen by rescuer without difficulty.

## REMOVE MOUTH AND INHALE

During this time, rescuer can hear and feel escape for air from lungs. Readjust position if air does not flow freely in and out of victim's lungs.

Continue at a rate of 12 to 20 times per minute.

Breathing should be normal in rate with only moderate increase in volume, so that rescue breathing can be continued for long periods without fatigue. Do not breathe too forcibly or too large a volume if victim is an infant or small child.

Section 1

# Introduction & Specifications

## 1-1. INTRODUCTION

1-2. The Model 5215A Precision Power Amplifier is a dc coupled, broad band inverting amplifier with a set gain of 100. The 5215A is used in combination with the 5200A AC Calibrator for a combined output ranging from 100 (100.000) to 1100 (1100.000) volts rms at frequencies up to 100 kHz.

1-3. Connection of the Model 5200A AC Calibrator with the supplied factory cable provides all the analog signal and remote programming data required.

1-4. The amplifier output cable is installed on the front panel. It may be installed on the rear panel for system operations if desired as Option —07. The standard output cable is a permanently attached, three foot long, four wire, low capacitance cable which allows remote sensing, high output current and high frequency operation.

1-5. Equipment protection is provided by the Fault and the Overload circuits. Activating the fault circuit automatically reverts the unit to the Standby mode and removes any voltage present from the output. Faults can originate from procedural errors or equipment failure. A fault due to procedural error can be removed by resetting the systems and performing the restarting procedure. An overload error can be corrected by removing the overload from the circuit. Return to operate will occur automatically when the overload is removed, unless the overload is accompanied by a fault. In this case, power must be removed and restored to remove the indications.

## 1-6. SPECIFICATIONS

These specifications apply when using the 5200A on the 1000 volt range with the 5215A and its supplied interface cable. Refer to the 5200A data sheet for other voltage ranges, frequency accuracies and slew rates.

### OUTPUT VOLTAGE RANGE

100V to 1099.999V rms

### FREQUENCY RANGE

10 Hz o 100 kHz. (120 kHz typical)

### RESOLUTION

1 mV

### AMPLITUDE ACCURACY

(For 90 day, 23°C±5°C, after 1 hour warmup)
(Maximum Load—zero to full load)

| 1000V Range | (X% of setting + Y% of Range) |
|---|---|
| 10 Hz to 30 Hz | (0.12 + 0.005) |
| 30 Hz to 20 kHz | (0.04 + 0.002) |
| 20 kHz to 50 kHz | (0.08 + 0.005) |
| 50 kHz to 100 kHz | (0.10 + 0.01) |

### AMPLITUDE LIMITS WITH TEMPERATURE

(0°C to 18°C and 28°C to 50°C)

Add ±(0.035 X Accuracy) per °C to the stated accuracy limits.

### SHORT TERM AMPLITUDE STABILITY

The random charge in rms value will be less than (0.0007% of setting +0.0005% of range) p-p for the 1 kHz

thru 100 kHz ranges and 0.005% p-p of range for the 100 Hz range over a 10 minute interval with constant line, load and temperature using an rms responding meter. (Fluke 931B or equivalent.)

### LONG TERM AMPLITUDE STABILITY
(At Constant Line, Load and Temperature)

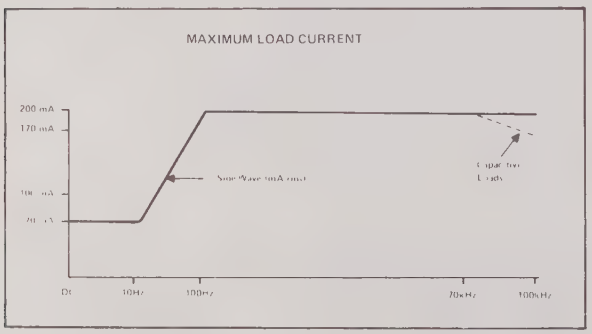
| | 24 Hours | Six Months |
|---|---|---|
| 10 Hz to 20 kHz | 0.01% of setting | 0.02% of setting |
| 20 kHz to 100 kHz | 0.02% of setting | 0.04% of setting |

### MAXIMUM CAPACITIVE LOAD
1500 pF (Not to exceed rated Load Current)
(170 mA allows 270 pF at 1000V/100 kHz)

### OVERLOAD PROTECTION
Overload Limit protects against input noise spikes and momentary output overloads.

Overload Trip protects against input overdrive conditions, steady state output overloads and short circuits.

### MAXIMUM LOAD CURRENT




### DC OFFSET VOLTAGE
(For 90 days, 23°C ±5°C, after 1 hour warmup)
±10 mV at the output

### DC OFFSET VOLTAGE LIMITS WITH TEMPERATURE
(0°C to 18°C and 28°C to 50°C)
±1.0 mV/°C at the output

### TOTAL HARMONIC DISTORTION
(Bandwidth 10 Hz to 1 MHz)

(Resistive loads greater than 1.5k ohm or Capacitive loads less than 1000 pF)

10 Hz to 20 kHz ..... (0.05% of setting)
20 kHz to 50 kHz ..... (0.07% of setting)
50 kHz to 100 kHz ..... (0.1% of setting)

(Resistive loads less than 1.5k ohm or Capacitive loads greater than 1000 pF)

10 Hz to 20 kHz ..... (0.05% of setting)
10 kHz to 20 kHz ..... (0.1% of setting)
20 kHz to 50 kHz ..... (0.17% of setting)
50 kHz to 100 kHz ..... (0.25% of setting)

### RANDOM NOISE
(1 MHz bandwidth)
Less than 100 mV rms

### LINE RELATED NOISE
Less than 50 mV rms

### LINE REGULATION
±0.001% of setting for 10% change in line voltage.

### INPUT POWER
100, 115, 200, 230V ac±10%, internal jumper selected, 50 to 60 Hz. Receptacle on rear panel for 5200A input power.

### INPUT LINE CURRENT
The United States National Electrical Code requires that the two lines cords on the 5215A, under full load conditions, be connected to a 20A rated branch circuit with 15A rated receptacles. For international use, refer to local standards. Line currents are listed on page 1-3.

### MAXIMUM ISOLATION VOLTAGE
Output common may be floated up to ±10V dc or rms from chassis to reduce common mode errors.

### DIMENSIONS (Case only)
10½" (267 mm) H x 17" (432 mm) W x 24.68" (627 mm) D

### WEIGHT
120 pounds (54.5 kg)

### EXTENDED USAGE
The 5215A will typically provide the following extended output voltages and frequencies when the line voltage is kept at the nominal value or above:

1200V rms up to 120 kHz with 100 mA output capability.

### OUTPUT CABLE
Extends three feet beyond the front panel. Special cable is used to provide remote sensing at the covered dual banana plug (with ¾" spacing) at the end of the cable. A storage receptable is located on the front panel to hold the output cable safely when not in use. Option —07 routes the cable out two feet beyond the rear panel.

### SAFETY FEATURES
When the ac power is turned on, the amplifier is automatically set to the Standby condition and a 1¼ by ½

**INPUT LINE CURRENT**

(At Full Load)

| | | 100V | 115V | 200V | 230V | |
|---|---|---|---|---|---|---|
| Control Supply Cord | 50 Hz | 2.0A | 1.8A | 1.0A | 0.9A | (Amp rms) |
| | 60 Hz | 1.9A | 1.6A | 1.0A | 0.8A | |
| High Voltage Supply Cord | 50 Hz | 14.5A | 12.4A | 7.2A | 7.1A | |
| | 60 Hz | 13.9A | 12.0A | 6.9A | 6.6A | |

inch red arrow (lightning bolt) is illuminated to indicate that potentially dangerous output voltages could be present due to remote programming inputs. When output voltage is commanded a ¼ by 1 inch red "OPERATE" lamp is illuminated.

Two step turn-on is provided by calling the 1000 volt range from the 5200A (local or remote modes) which causes the 5200A to return to Standby. After a 10 ms delay, the 5200A operate command can then be initiated to provide an output voltage from the 5215A.

The 5215A meets the safety requirements of IEC348.

## CALIBRATION REQUIREMENTS

The 5215A is calibrated at the factory by instrumentation traceable to the National Bureau of Standards. Periodic calibration of the 5215A may be accomplished using thermal converters and other general purpose laboratory equipment.

## COOLING

Forced air cooled. Air enters through a reusable filter on the rear panel. Air exits upward from the rear panel and along both sides (Main rear panel outlet may be redirected to the right side at the rear of the instrument.)

## TEMPERATURE

0°C to +50°C operating
40°C to +75°C storage

## RELATIVE HUMIDITY

0 to 80% (0°C to +40°C)
0 to 70% (+40°C to +50°C)

## SHOCK

15g, 11 ms half-sine wave

## VIBRATION

3.1g, 10 Hz to 55 Hz

## ALTITUDE

0 to 10,000 ft (3048 meters) operating [Above 7000 ft. (2134 meters) when using 50 Hz line power derate maximum output current by 40%].

50,000 ft (15240 meters) non-operating.

## REMOTE PROGRAMMING

Using the 5200A with the 5215A allows the 5200A to program the 5215A either manually from the 5200A's front panel controls or through the 5200A's remote programming input.

The 5215A is supplied with a two-foot 5200A/5215A interface cable which will allow the 5215A to sit on either side of the 5200A or on top of the 5200A. It is not recommended to put the 5215A below the 5200A due to the upward warm air discharge.

# Section 2
# Operating Instructions

## 2-1. INTRODUCTION

2-2. This section contains information essential for correct operation of the Model 5215A. Should any difficulties be encountered during operation, please contact the nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc. A complete list of Sales Representatives is located at the rear of this manual.

## 2-3. SHIPPING INFORMATION

2-4. The Model 5215A was packaged and shipped in a foam packed cardboard carton. Upon receipt, a thorough inspection should be performed to reveal any damage in transit. Special instructions for inspection and claims are included in the carton.

2-5. If reshipment is necessary, the original container should be used. If it is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the Model number when requesting a new container.

## 2-6. INPUT POWER

2-7. The power amplifier can be operated from either a 100, 115, 200 or 230V ac 50 or 60 Hz power line. A jumper system on the power supply section allows selection of the appropriate line voltage. Select the proper jumper and fuse combination for the local line voltage using the following procedure:

a. Verify that neither line cord is connected to a power source.

b. Remove the top dust cover and left inner cover from the instrument.

c. Locate the input power terminal strips shown in Figure 2-1. The layout is also shown on the transformer cover.

d. Connect the jumpers as shown in Figure 2-1 and Table 2-1.

e. Replace the inner dust cover.

f. Install 15 and 5 amp fuses if the 100 or 115 volt input line voltage has been selected or 8 and 2 amp fuses if the 200 or 230 volt input has been selected.

## 2-8. INSTALLATION

2-9. The power amplifier is designed for bench-top use or it can be installed in a standard 19 inch equipment rack with mounting brackets. Rack mounting is done as follows:

a. Remove the vertical decals from the sides of the two front handle castings.

b. Remove the screws from the front corner casting which match the hole patterns in the rack mounting brackets.

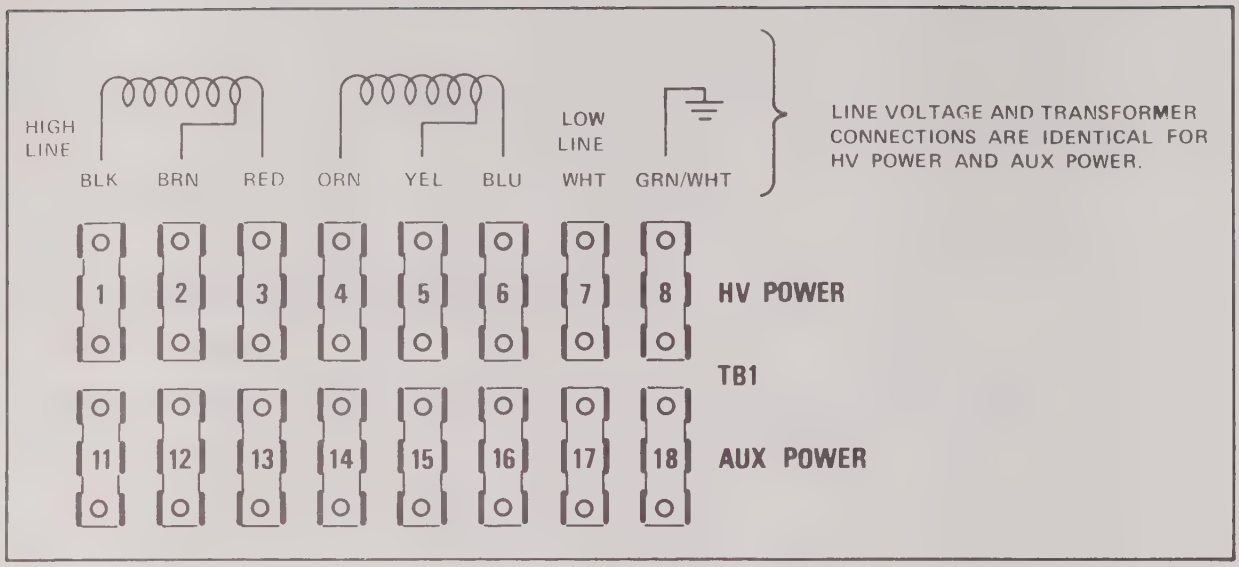



Figure 2-1. INPUT POWER TERMINAL STRIPS

Table 2-1. INPUT LINE VOLTAGE JUMPER CONNECTIONS

| LINE VOLTAGE | HV POWER JUMPER | HV POWER JUMPER | JUMPER |
|---|---|---|---|
| 100 | 1 to 4 | 2 to 5 | 5 to 7 |
| 115 | 1 to 4 | 3 to 6 | 6 to 7 |
| 200 | 2 to 4 | 5 to 7 | 7 to 7 |
| 230 | 3 to 4 | 6 to 7 | 7 to 7 |
| | AUX POWER | | |
| 100 | 11 to 14 | 12 to 15 | 15 to 17 |
| 115 | 11 to 14 | 13 to 16 | 16 to 17 |
| 200 | 12 to 14 | 15 to 17 | 17 to 17 |
| 230 | 13 to 14 | 16 to 17 | 17 to 17 |

c. Attach the rack mounting brackets to the corner castings with No. 8-32 PHP screws.

## 2-10. OPERATING FEATURES

2-11. In the Calibrator Mode the 5215A is controlled from the 5200A AC Calibrator, either from the 5200A front panel or indirectly through the 5200A Remote Control Unit. The output is the voltage selected by the 5200A on the 1000 volt range. The output sensing signal is returned to the 5200A for maximum overall accuracy.

2-12. The location and function of all front panel controls, connectors, and indicators are shown and described in Fig. 2-2 (Page 2-5) and Table 2-2 (Page 2-11).

The rear panel connectors and fixtures are shown and described in Fig. 2-3 (Page 2-7) and Table 2-3 (Page 2-6).

## 2-13. OPERATING NOTES

### 2-14. AC Line Connections

2-15. Power is input to the unit on two separate lines. One line provides power to the high voltage system while the other supplies the auxiliary power system. Each input line is individually fused. The voltage is selectable, as previously described and the input frequency may be either 50 or 60 Hz. Both input power cords have three prong polarized plugs. The round pin on the plugs connect the chassis to earth ground, therefore ensure that it is connected to a high quality earth ground.

2-16. The 5215A requires a significant amount of line power. Table 2-4 contains the RMS line currents under full load conditions as controlled by line voltage setting and input frequency. The requirements for both the high voltage and auxiliary power line cords are listed. The high voltage line cord is rated at 18 amps.

Table 2-4. INPUT LINE CURRENTS

| SUPPLY | INPUT FREQ. | INPUT VOLTAGE | | | |
|---|---|---|---|---|---|
| | | 100 | 115 | 200 | 230 |
| HV | 60 Hz | 13.9 | 12 | 6.9 | 6.6 |
| AUX | 60 Hz | 1.9 | 1.6 | 1 | 0.8 |
| HV | 50 Hz | 14.5 | 12.4 | 7.2 | 7.1 |
| AUX | 50 Hz | 2 | 1.8 | 1 | 0.9 |

2-17. The operator must verify that local and/or national standards for outlet receptable and branch circuit are met. For example: In the United States a 20A rated branch circuit is required for a 115V ac 60 Hz source. The 5215A connectors are rated at 15A and can be plugged into either a 15A or 20A rated outlet.

## 2-18. Input Connectors

2-19. Control of the 5215A is from a connector on the rear panel. Both the input signal and controls are made through a 25-pin connector.

## 2-20. Output Connections

2-21. The output cable is permanently attached to the unit at the front panel. As part of the —07 Option, it can be attached at the rear panel for system operation. The 3-foot long, four-wire, low capacitance cable has a hooded protective cover for operator safety. Selection of the —07 Option for a rear connector reduces the length of the output cable to two feet. Remote sensing is accomplished by connecting the Output and Sense HI lines and the output and sense LO lines inside the sealed protective cover.

## 2-22. Output Capabilities

2-23. The 5215A can deliver up to 200 mA rms ac. Attempts to draw currents in excess of this amount result in an overload which removes the output and causes the amplifier to either retry its programmed output or to return to standby. Before using the 5215A as a source, insure that the recipient unit does not load the amplifier in excess of these limits.

## 2-24. Ground Connection

2-25. If desired, the amplifier OUTPUT LOW can be grounded to the chassis at the front panel by connecting a shorting link between the two terminals. The chassis ground is connected to an earth ground through the line cords, provided the ac line cord is properly grounded. If floating the amplifier output above ground is desired, when the load cannot be disconnected from the earth ground, remove the shorting link from between the two front panel terminals and connect the OUTPUT LOW terminal to the earth ground on the load. The maximum allowable differential between OUTPUT LOW and chassis ground is 10V ac rms.

**CAUTION!**

**The OUTPUT LOW terminal of the 5215A should never be left floating during operation. If the strap between OUTPUT LOW and CHASSIS GROUND is not present, then verify that through the output cable and the load, a connection with CHASSIS GROUND is present.**

## 2-26. System or Combined Operations

2-27. The 5215A can be directly combined with a 5200A for operation, or through a Remote Control Unit (RCU) controlled by a computer test system.

## 2-28. Calibrator Operation

*NOTE*

*During combined operations, the 5200A should not be positioned on top of the 5215A. Overheating can result when the 5200A intakes discharged air of the 5215A. Also, transformer coupling may result at line related frequencies.*

2-29. 5200A LOCAL OPERATION

2-30. Once the 5215A is prepared for operation, i.e., the 5200 Control Cable connected, the POWER switch is ON and the 5200A in the 1000V range, control of the 5215A rests with the 5200A. The following procedure can be followed to operate in the clibrator mode:

a. Connect the control cable between the J32-5205 connetor on the 5200A and the 5200A Remote Connector on the rear panel of the 5215A.

b. Set the POWER switch to the ON position.

c. The INSTRUMENT ON and WARMUP indicators are illuminated.

d. After a delay of approximately 30 seconds the WARMUP indicator extinguishes.

e. Select the desired amplitude (1100V rms max) and frequency (100 kHz max) on the 5200A front panel.

f. Set the 5200A mode switch to OPERATE.

g. The OPER indicator on the 5200A and the OPERATE indicator on the 5215A illuminate. The STDBY indicator on the 5200A extinguishes. The voltage selected on the voltage dials (100 to 1100 volts) is present at the output connector.

*NOTE*

*In case of a fault, the 5215A will return to STDBY. The 5200A will still be in the OPERATE mode, although the indicator will show STANDBY. Reset the fault by turning the STDBY-OPER switch on the 5200A front panel to the STDBY position.*

Table 2-2. FRONT PANEL COMPONENT DESCRIPTIONS

| REF NO. | NAME | FUNCTION |
|---|---|---|
| 1 | POWER Switch | Applies line voltage to the Auxiliary (AUX) power supplies. After approximately 30 seconds power is applied to the High Voltage (HV) supply. |
| 2 | WARMUP Indicator | Illuminated for approximately 30 seconds after the POWER switch has been turned ON. This allows the Power Amplifier time to heat the tube filaments prior to applying high voltage to the system. |
| 3 | OPERATE Indicator | Illuminated when the Operate mode has been selected. |
| 4 | FAULT Indicator | Illuminated when a fault occurs in the system. A procedural or minor fault may be corrected and the indicator extinguished by returning the unit to the Reset Fault mode. This can be accomplished by returning the 5200A mode to standby and then back to operate, either from the 5200A front panel or the RCU. |
| 5 | OVERLOAD Indicator | Illuminated when an overload is placed on the power amplifier. To extinguish, power must be removed and reapplied. If accompanied by the fault indication, there is a fault condition which must be reset by turning power OFF and ON. |
| 6 | INSTRUMENT ON Indicator | Illuminated when the POWER switch is turned ON. Warns that dangerous High Voltages are present in the unit and may be present at the output terminals. |
| 7 | OUTPUT LOW Terminal | Provides a front panel connection for OUTPUT LOW. The maximum allowable differential between Output LOW and chassis is 10V ac rms, the maximum continuous current 50 mA, peaking at 5A for 10 ms. |
| 8 | CHASSIS GROUND Terminal | Provides a front panel connection for chassis ground. |
| 9 | OUTPUT Terminals | Permanently attached 4-wire output cable, 3 feet in length. The Output HI and Sense HI wires were connected at the HI Terminal of the output connector. The Output LO and Sense LO wires are connected at the LO terminal of the output connector. This configuration provides the minimum capacitance required at high frequencies. |
| 10 | Cable Storage | This storage area is provided as a safety feature. When the output cable is not in use, the output terminals can be inserted into the internal connectors. |

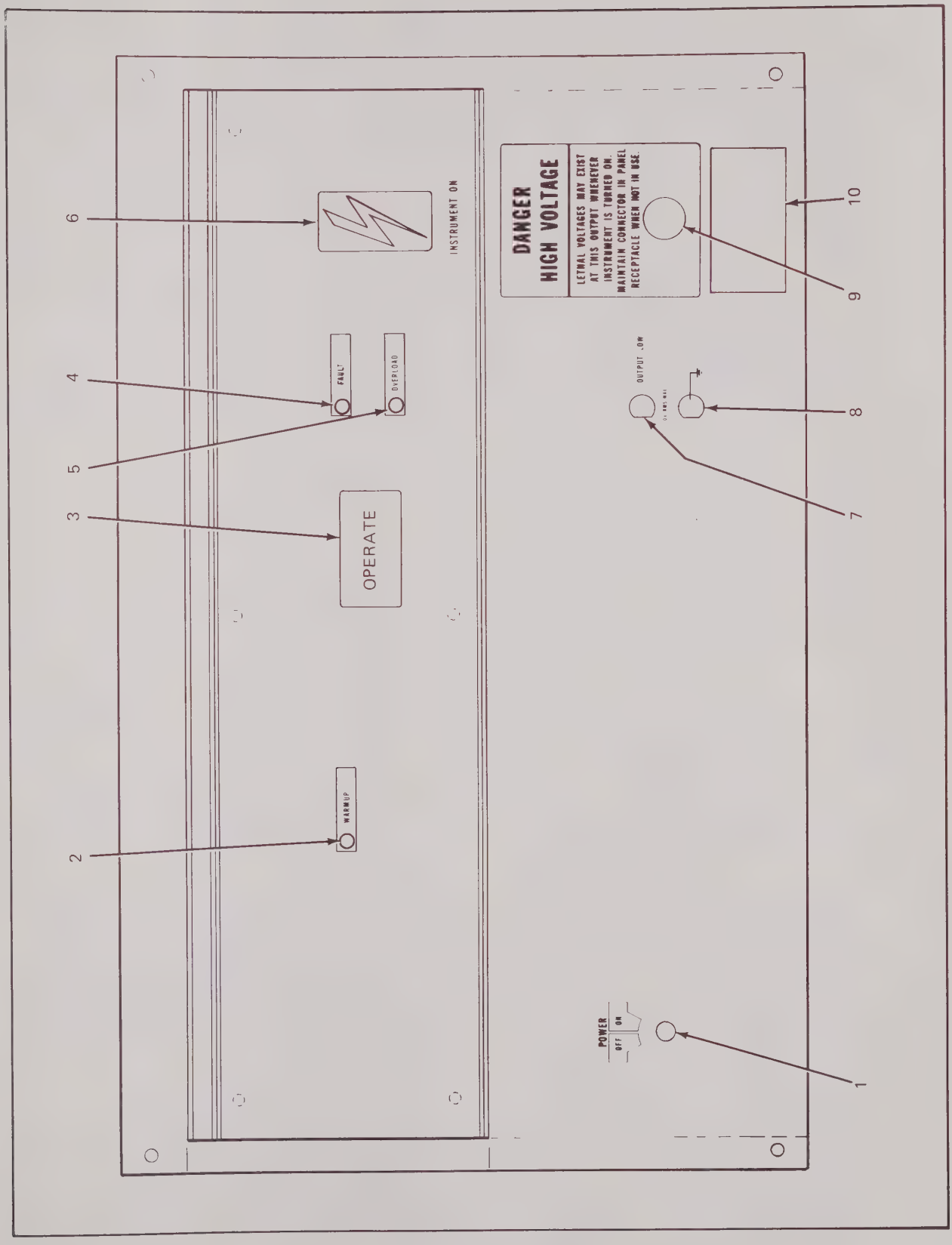



Figure 2-2. FRONT PANEL

Table 2-3. REAR PANEL COMPONENT DESCRIPTION

| REF NO. | NAME | FUNCTION |
|---|---|---|
| 1 | Optional Output Terminals | This filler plug is removed and the output cable exits from this point if the –07 Option is installed. This option repositions the Output connector to the rear panel for system use. |
| 2 | Auxiliary Power Line and Fuse | The permanently attached, No. 16 AWG wire, three-prong power cord supplies the line voltage to the auxiliary power supplies and 5200A power through F2, a 5 amp Slo-Blo fuse. |
| 3 | High Voltage Power Line and Fuse | The permanently attached, No. 14 AWG wire, three-prong power cord supplies the line voltage to the High Voltage Power Supply through F1, a 15 amp Slo-Blo fuse. |
| 4 | Convenience Outlet | The power available at the convenience outlet is taken directly from the auxiliary power line input. It is a standard American style 3 prong connector. |
| 5 | 5200A 25-Pin Connector | Input for signal and controls from the 5200A. |
| 6 | Air Intake and Filter | Washable filter to clean air used to cool the unit. |
| 7 | Air Outlet | Shield directs flow of air exhaust. Normally, exhausted air is directed upward, however, the shield can be removed and repositioned to direct the air flow to the right of the instrument, if this path of flow is obstructed in some manner. It should not be positioned to the left toward the air intake or downwards. |

2-31. 5200A REMOTE OPERATION

*NOTE*

*For operation of the 5200A Remote Control Unit (RCU) see Section 6 of the 5200A manual.*

2-32. When the 5200A is controlled by an RCU during Calibrator Operation, the timing of the Range Select and Operate commands becomes critical. Two separate transfers, separated by at least 10 ms, are required to obtain proper operation of the 5215A. Use the following format for the two transfers.

a. First transfer command should include:

1000 Volt range
Standby
Any other controls and setting desired.

b. Second transfer command should include:

1000 Volt range
Operate
A repeat of any other controls and settings in the first transfer command.

*NOTE*

*At least 10 ms must elapse between the two transfer commands. The READY STATUS flag may be used for timing between the two transfer commands or ignored.*

2-33. Changes in settings and controls, including Standby and Operate are accepted in one transfer by the RCU as long as the 1000V range is included. The RCU Ready flag delay varies with the selected frequency of the 5200A due to settling time within the instrument. If the flag is to be used for timing, check the 5200A manual for those specifications.

## 2-34. Operate Fault

2-35. A fault will result from an invalid Operate command. If the MODE switch is set to the OPERATE position prior to the expiration of the warmup period the FAULT indicator will illuminate. Clear the fault and extinguish the indicator by returning the MODE switch to STDY and then, after the WARMUP indicator has extinguished, return the MODE switch to OPERATE.

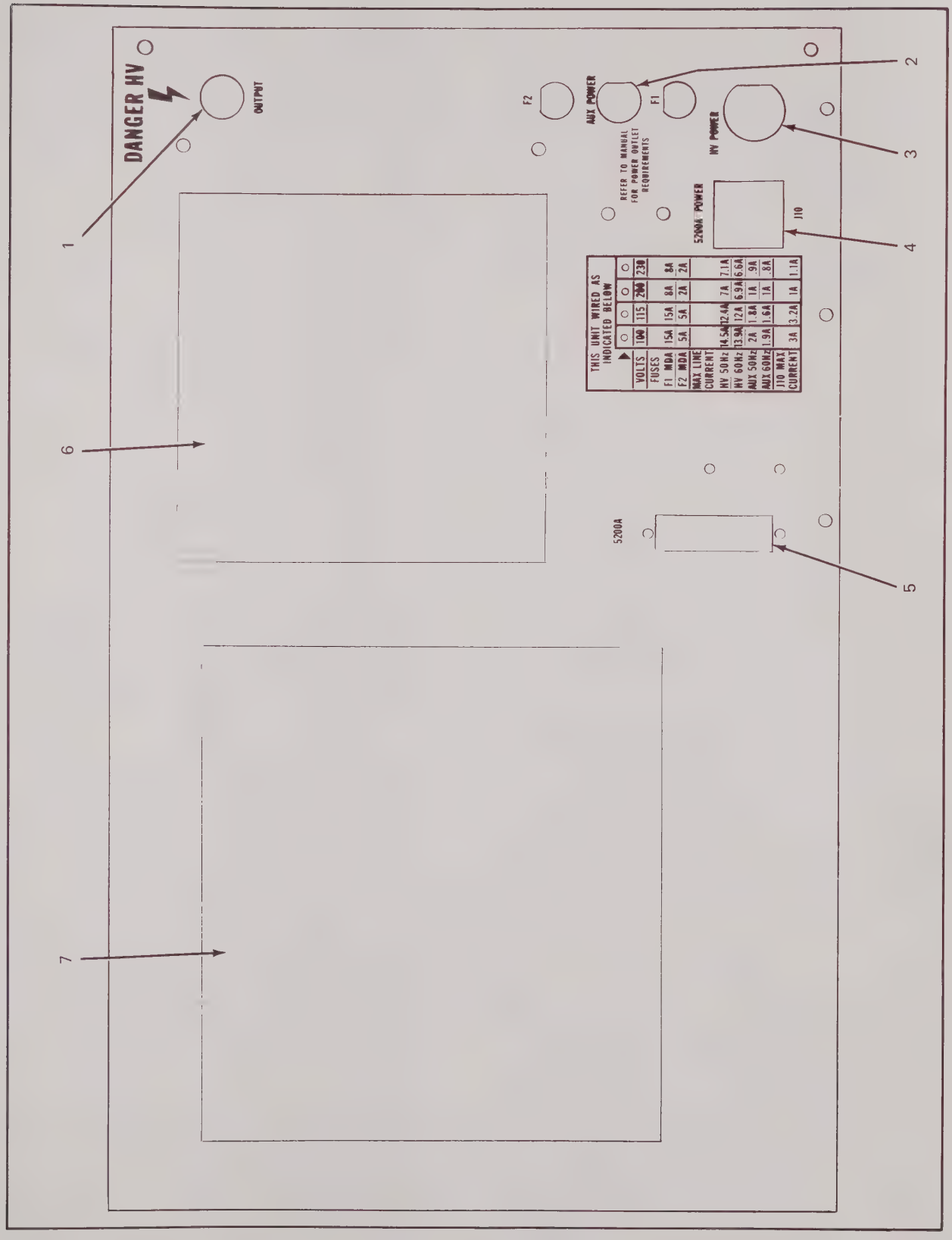



Figure 2-3. REAR PANEL

## 2-36. Equipment Faults

2-37. Fault indications also result from internal instrument failures, such as: no cooling, severe overloading of the high voltage power supplies or high voltage present during the warmup period. This type of fault disrupts the amplifier loop causing the OVERLOAD indicator to illuminate in addition to the FAULT indicator. Returning the MODE switch to STDBY does not clear this type of fault. Restart the system by turning the POWER switch to OFF, then ON, wait 30 seconds for the WARMUP indicator to extinguish and then set the 5200A MODE switch to OPERATE. Insure the 5200A is in Standby before starting the restart procedure. If the FAULT and OVERLOAD conditions persist, repair of the instrument is required.

# Section 3
# Theory of Operation

## 3-1. INTRODUCTION

3-2. This section contains the theory of operation for the Model 5215A Precision Power Amplifier. The theory description is presented first in a simplified block diagram (Figure 3-1), then a functional block diagram, and then a circuit explanation. A complete set of schematic diagrams is contained at the rear of the manual.

3-3. The 5215A Precision Power Amplifier provides amplification at the fixed gain of minus X100 to any signal input, up to the specification limits of 1100V ac rms at 100 kHz.

## 3-4. SIMPLIFIED BLOCK DIAGRAM DESCRIPTION.

3-5. Selection of the operating mode and status is done within the Logic Assembly. When power is applied the Initializing circuit readies the system while the instrument is checked for faults. The signal to be amplified and control signals are applied from the 5200 connector on the Rear Panel, provided the 5200A has the 1000V range selected.

3-6. The signal is amplified in the preamplifier then applied to the power amplifier. The power amplifier is a Class AB push-pull type using two tubes connected in parallel in both the upper and lower portions of the circuit to provide sufficient output current capability. The output is sensed and returned to the preamplifier to control the input by controlling the output from the 5200A.

3-7. The Power Amplifier is supplied with ±2.5 kV and the Preamplifier with -2.5 kV. The various low voltage power supplies and regulator within the instrument are supplied from the Auxiliary Supplies.

### 3-8. Power Supply Assembly

3-9. Line Power is input to the Power Supply Assembly on two different line cords. Power for the high voltage circuits enters on P8 and for the Auxiliary circuits on P9. This allows operation of the Auxiliary circuits while troubleshooting and/or calibration without the danger of the high voltage circuits. The high voltage circuits output ±2.5 kV to the Power Amplifier and -2.5 kV to the Preamplifier. Details on the various portions of the high voltage circuit and the auxiliary voltages available are contained in the following sub-paragraphs.

3-10. HIGH VOLTAGE RELAY DRIVER

3-11. Power applied to the instrument cannot reach the High Voltage Transformer until K1 is energized. P56-8 brings in the control signal from the Logic Assembly. This signal goes low approximately 30 seconds after the POWER switch is set to the ON position. Prior to that time the Optical Isolator U1 has been cutoff, preventing K1 from energizing. Once low, U1 conducts, cuts off Q1, which causes the current source Q2 to turn on Q3 and energize K1. Q2 also supplies current to the zener VR5 to provide a regulated 110V to the relay coil, optimizing the dissipation of the relay under varying line voltages. Diodes CR1 through CR4 and C1 provide a 110V supply to the relay driver.

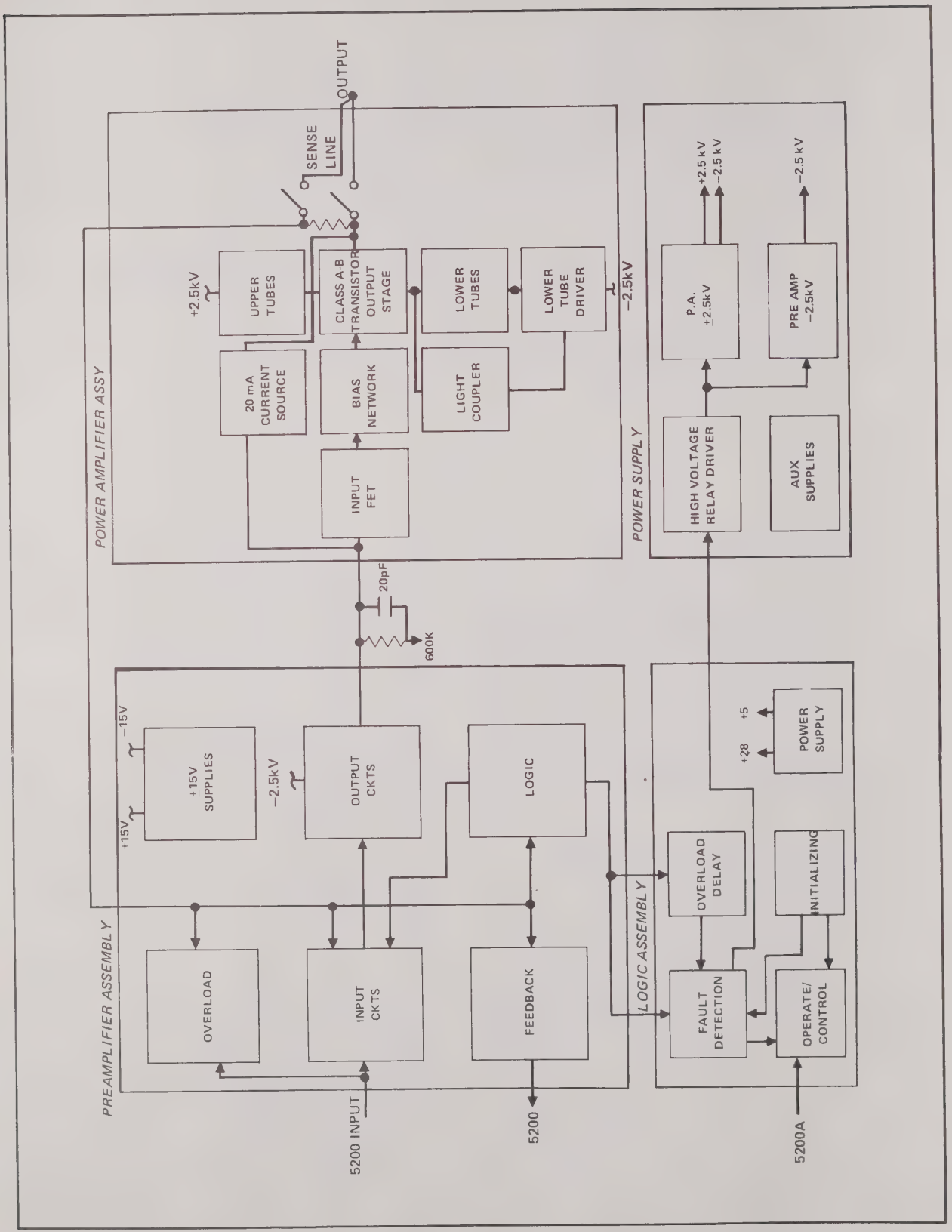



Figure 3-1. MODEL 5205A BLOCK DIAGRAM

**CAUTION!**

**The Relay Driver circuitry is located on the Primary side of the HV Transformer. Extreme care should be taken when connecting any test instruments to the circuitry.**

3-12. POWER AMP ±2.5 kV SUPPLY

3-13. Operation of both the positive and negative supplies are identical. The positive voltage supplies V1 and V2 on the Tube Mounting Assembly while the negative supply goes to V3 and V4 on the Lower Tube Assembly. In both cases the transformer secondary is rectified by a bridge rectifier and then filtered by C11 or C12. Each Supply has a bleeder assembly connected to provide a discharge path for the filtering capacitor if the Power Amplifier is not connected to the circuit. Discharge takes approximately 30 seconds. Each circuit has a decoupling network consisting of a resistor (R22 and R12) and two diodes (CR25, CR26 and CR17, CR18). A monitor to the Logic Assembly is provided from each supply.

3-14. PREAMP –2.5 kV SUPPLY

3-15. The Preamp supply rectifies the transformer secondary with CR13 and CR14 and then filters it with C13. A bleeder assembly is provided to discharge the filtering capacitor to a safe level if the Preamp is not installed. Discharge takes approximately 30 seconds. This Voltage supplies the 1.9 kV regulator on the Preamp.

3-16. AUXILIARY SUPPLIES

3-17. Line power input on the auxiliary power circuit is tapped to provide an outlet for the 5200A on the rear of the instrument. It also supplies inputs to the primary of the Preamplifier Auxiliary Transformer T3, the Power Amplifier Auxiliary Transformer T4 and the Low Capacity Transformer T2. Outputs from the Low Capacity transformer secondary are used on the Power Amplifier.

## 3-18. Logic PCB Assembly

3-19. When power is applied to the instrument the initializing circuits prepare the circuits for operation. Control is exercised through the operate/control stage, with control originating at the 5200. Any fault and/or overload will be detected and returned to the operate control stage for appropriate action. The +5 and +28 power required for the logic and relay circuits are generated within the Logic Assembly.

3-20. INITIALIZING CIRCUITRY

3-21. When power is applied to the instrument U42-5 goes high from the Warmup Delay circuit to disable U14-10, which prevents the high voltage control relay from energizing, also U2-6 goes low disabling the overload circuitry. At the same time U20-2 goes low to illuminate the Warmup indicator, clear the Operate FF at U4-13 and enable U14-12 so that if high voltage is present it will clear the Trouble FF and generate a fault. The length of the Warmup period is controlled by R129/C53 and should be approximately 30 seconds. The Power Up Initialize circuit (R131/C54) generates a pulse at Power Up to set the Trouble FF. It also, through the fault gate, insures the Operate FF is cleared, so both devices start in a known condition.

3-22. Once the Warmup delay period has passed U42-5 goes low, extinguishing the Warmup indicator.

3-23. OPERATE/CONTROL

3-24. The operate command originates from the 5200A interface. It is wire ORed with a permanent HIGH at U2-3 for the control line and U4-9 for the operate line.

3-25. The U30 optical isolator returns the status and overload conditions to the 5200A. Control of the inputs is discussed later.

3-26. 5200 Interface

3-27. The control command at P41-6 activates half of U31 for a high at U4-6 which enables U3-9 for the upcoming operate command, enables U3-5 for the return status, and pulls the control line low at U2-3. In addition U1-8 and P44-7 go high after a 33 ms delay for use in the preamplifier. The low at U8-6 activates K1 to connect the 5200A guard to sense low in the 5215A.

3-28. Operate FF

3-29. Once U2-3 has been pulled low by the interface, R124/C44 delays the signal 3 to 9 ms. At the end of this delay the Operate FF J Input, U41-4 goes high. The operate command is delayed slightly by R121/C43 and then applied to U41-1 as a low going clock to set the $\overline{Q}$ output low. This is used to set U5-6 high to return the status to the interface, to output a low $\overline{5205A\ OPERATE\ COMMAND}$ at P44-3, and to turn on Q1 and Q2 which illuminates the OPERATE incandescent lamps and outputs a low to the power amp at P43-27, 28. The high at the Q output is applied to U43-10 and U14-1 for use in fault detection.

3-30. If the control line was not high at the Operate FF prior to the arrival of the operate command the flip-flop would not be clocked and a fault would result. Since the delay in the control line appreciably exceeds that of the operate line the control signal in any remote or 5200A operation must precede the operate command by at least 10 ms.

3-31. FAULT DETECTION

3-32. Two types of faults can exist within the system. A major fault requires the removal of power to clear the fault detection system. A minor fault can be cleared by setting the mode switch to STDBY-RESET and then returning it to OPERATE.

3-33. Minor Faults

3-34. A minor fault uses the fault gate output, delayed by R122 C41, to clear the Operate FF, which returns the instrument to standby and illuminates the fault indicator. Minor fault inputs to the fault gate come from U43-8 when the operate FF is set but there is no operate command and from the dual control error detection circuit when two or more control signals are present. Inputs are also supplied from the U21 quad comparator. The output at U21-14 goes low if the -1 limit sensor has a current greater than 200 mA for a time period determined by R88/C23. The +1 limit sensor goes low at U21-13 when the comparator senses a voltage greater than 200 mV. The +5V limit sensor goes low at U21-1 when the +5 volt supply drops to 4.5 volts.

3-35. The absence of the $\overline{\text{NEG HV}}$ signal at P44-1 from the preamp applies a low at U15-4 which clears the Operate FF, after the delay of R122/C41. The resulting low at U14-1 is combined with the low operate command at U14-2 to illuminate the fault indicator. This gate will also operate if the operate command clocks the flip-flop when there is no control signal present. Both conditions will cause a minor fault without using the fault gate.

3-36. Major Faults

3-37. A major fault clears the Trouble FF, in addition to generating a fault signal from the fault gate. The only method of setting the Trouble FF to remove the major fault is the Power-Up Initialize circuit, necessitating removing power from the system and then resetting the power switch to ON.

3-38. The quad comparator U22 activates the Trouble FF if either U22-1 or U22-2 are brought low when the NEG Supply current monitor at P43-12 or the POS Supply curent monitor at P43-10, respectively, exceed their 300 mA limits for 100 ms. U22-14 will go low if the signal from the Fan switch is interrrupted for approximately 6 seconds. The fourth comparator input is the overdrive which originates in the preamp. If the overdrive signal goes high, U22-13 will go low and clear the Trouble FF, shutting down the system.

3-39. If the transistors Q1 and Q2 do not operate properly, i.e. Q1 conducting and Q2 cut-off, Q3 is turned on activating the Trouble FF. The +28V limit sensor in the U21 comparator will turn Q4 on when the input drops to 20V, cutting off Q2 and activating the trouble circuit.

3-40. A major fault is also generated when high voltage is sensed at P43-8 during the Warm-Up period. the signal, if present, will turn on Q10 to enable U14-13 so that when U14-12 is low during warmup the trouble FF is cleared.

3-41. OVERLOAD DELAY

3-42. The overload signal at P44-5 from the preamp illuminates the OVERLOAD indicator and activates the trip isolaters in the selected interface device. Since it does not generate a fault and the overload pulse could be quite narrow a one-shot is installed in the circuit to give a minimum width pulse. The width of the pulse at U42-9 is determined by 126/C47 and is approximately 0.5 seconds.

3-43. POWER SUPPLIES

3-44. +28V dc

3-45. The 21V rms at P43-17, 18 and P43-19, 20 is rectified at CR18 and filtered by C28. The 21V rms operates the incandescent lamps in the INSTRUMENT ON (lightning bolt) indicator. The +28 volts is used for the OPERATE indicators and various relays. The +28V is also used with Q5 and series regulator circuit to develop 5.6 volts for the pull-up resistor R73.

3-46. +5V dc

3-47. U25 is a 5 volt regulator which acts on the 8.5V rms supplied from the power supply. It is rectified at CR17 and filtered by C25-C27. Up to 400 mA is supplied for the use of the IC's on the logic assembly. Capacitors C1, C3, C10, C12 and C46-C56 are used for decoupling the integrated circuits on the assembly.

## 3-48. Preamplifier Assembly

3-49. The signal to be amplified enters the Preamplifier (Fig. 3-2) on the 5200 connector. The input signal is amplified and internal feedback applied to set the gain at 100 within the Input circuits. In the Output stage the instrument output voltage swing of ±1550 Volts is set. The output is sensed and returned to the Input, Logic, Overload and Feedback circuits. The Feedback

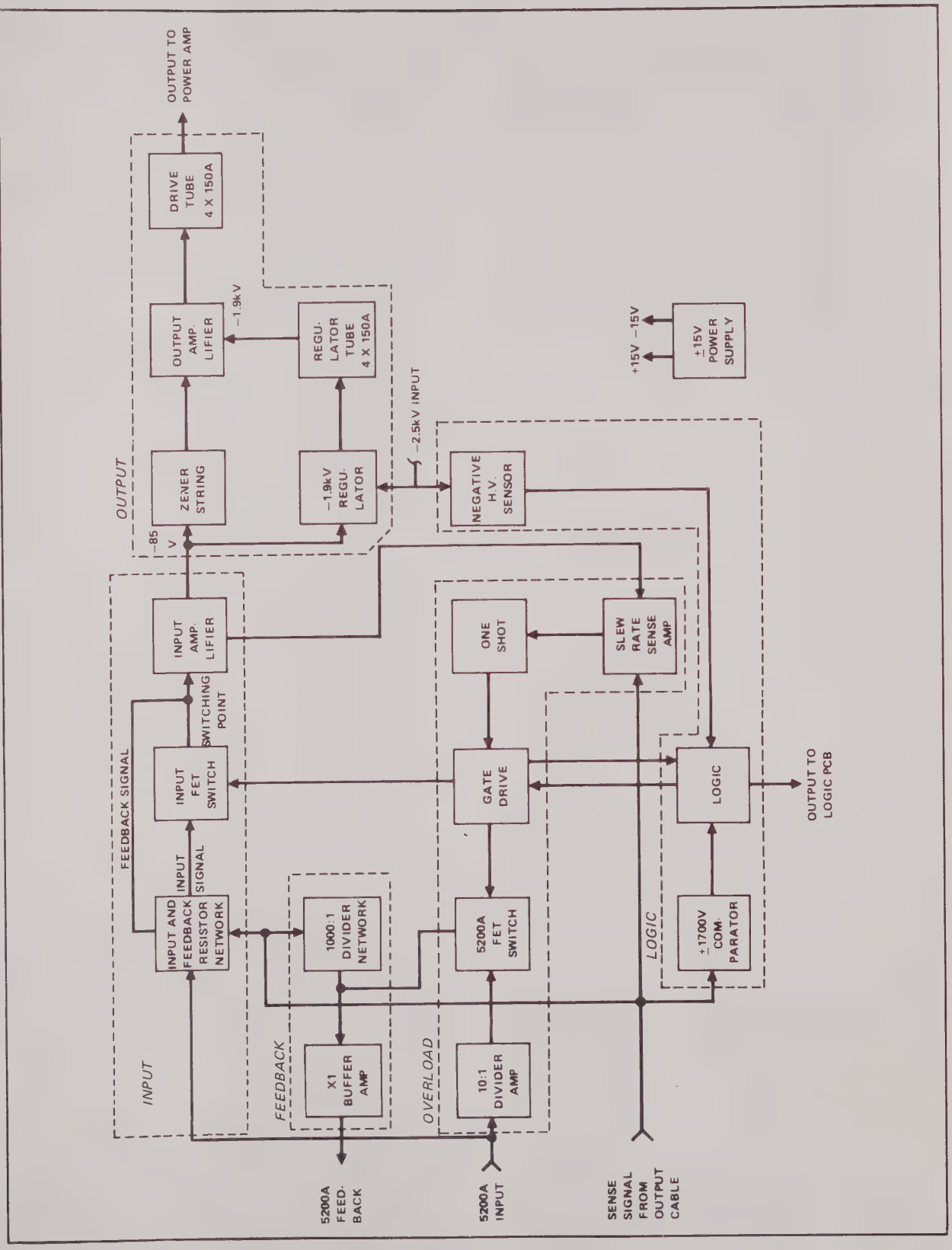



Figure 3-2. PRE-AMPLIFIER BLOCK DIAGRAM

circuit takes the sensed voltage, divides it and feeds it to the 5200A for use in stabilizing gain and control. The Overload circuits sense high output voltages or low supply to cut off the input to the preamplifier. The Logic circuits decode control inputs and supply status outputs to the Logic PCB. The ±15 volt power supply provides regulated ±15V dc to components on the preamplifier.

3-50. INPUT CIRCUITS

3-51. Input and Feedback Resistor Network

3-52. The gain of the 5215A is controlled with this circuit. The ratio of the 1M (R302) to the input resistance gives a gain of 100. R301 (10k) and the resistance of Q121 (40 Ω) combine for the hundred to one ratio.

3-53. Input FET Switch

3-54. Q121, the input FET switch interrupts the input signal when the instrument is in standby or overload. Since the resistance of Q121 is part of the input resistance any change in temperature will effect the resistance of the FET and through it the gain of the instrument.

3-55. Input Amplifier

3-56. Transistors Q128, Q132, Q138, Q140, Q147 and Q148 in conjunction with the Op-Amp U123 and their associated components make up a wide band dc coupled amplifier, which is the input amplifier. The input signal and feedback is summed at Q128, routed through Q132 and Q140 and then output to the next circuit at Q148. Transistors Q138 and Q147 provide current sources of 1.8 mA and 3.6 mA respectively. Op -Amp U123 keeps the instrument output offset near zero. Any dc voltage at the summing point is amplified by U123 and applied to the source of Q128, where it is amplified by the remaining stages. At the output the feedback, through R302 brings the summing point back to zero. Since the dc gain of U123 is high the dc offset of the instrument is determined by the characteristics of U123. Above 20 kHz the gain of U123 is rolled off by C124 and R127 so that the source of Q128 is held to zero volts ac by C128. As a result the gain of the input amplifier is determined by Q128 and the load capacitance at the collector of Q132 above 20 kHz.

3-57. OUTPUT CIRCUITS

3-58. Zener String

3-59. The zener string provides a dc path from the input amplifier across a potential of 1900 volts to the output amplifier. In the string the 50V, 100V and two of the nine 200V zeners are shorted with a jumper that can be removed to adjust the voltage on the output amplifier common to between -1850 and 1910 volts. The bias current through the string is the 3.6 mA supplied by the current source Q147. Frequencies above 150 kHz are bypassed around the string by C192.

3-60. Output Amplifier

3-61. After the zener string the input signal current goes to the output amplifier which provides an amplified low distortion current to the drive tube. Common for the output amplifier is kept at -1.9 kV dc potential, as set by the -1.9 kV regulator which allows the drive tube plate to fall to the -1550 volts required by the instrument output and still maintain the bias required on the tube. The amplifier consists of transistors Q182 through Q187 which are supplied a ±29V dc from C182, C183, CR182 and the 40 rms input. Q185 is used as a current source to take 1.7 mA of current from the 3.6 mA supplied by the zener string. The remaining 1.9 mA provides the amplifier with a full scale swing of ±1.9 mA so that when the signal swings -1.9 mA the output current to the tube is zero but the zener string remains biased to 1.7 mA from the current source. This bias keeps the impedance of the zener string low and prevents the distortion that would normally occur at the knee of the zener. The output from the amplifier at the emitter of Q182 is set in magnitude by Resistor R195 and the base voltage. This is applied to the cathode of the drive tube to develop the instrument output voltage at the tube plate. Distortion in the current output of Q182 is reduced by the diode connected transistors Q184, Q186 and Q187. The same voltage should appear across R195 and R197, therefore if 1.9 mA flows in R197 a current of 30 mA will flow in R195 and in turn in Q182 and the drive tube, providing the normal bias for the tube.

3-62. Drive Tube

3-63. The drive tube develops the instrument output voltage swing of ±1550 volts. Current from the output amplifier changes the tube plate to cathode voltage in response to the input signal thereby generating the instrument output. The screen grid voltage is set by VR185 and the resistor string R204 through R207. The plate load consists of R1 through R4, four 150k resistors in series, and the 20 pF inherent in the tubes plate to plate shield and the coaxial cable (plate to power Amp input) capacitance.

3-64. -1.9 kV Regulator

3-65. Regulation of the -1.9 kV at the Output Amplifier common is accomplished by regulating the input voltage to the zener string. As long as the input at the zener string is -85 volts the voltage at the junction of R151 and R158 and at U157-3 will be zero. Since U157-2 is tied to common and change in the zener string input

will effect the U157 Op Amp, and in turn Q161 and the optical coupler U160. The signal is passed across the coupler to the photo transistor which drives Q177 which drives the regulator tube V2, changing the common of the output amplifier and the input to the zener string, bringing the loop into balance. Q176 is used as a current limiter for the regulator and is set for a limit of 55 mA.

## 3-66. FEEDBACK CIRCUITS

### 3-67. 1000:1 Divider Network

3-68. Sense voltage for the 5200A is divided down to the required level by the 1000:1 divider network. The high voltage on the sense line is applied to the 1.0009M resistor (R304) and divided by 1.019k (R303) and the shunt resistors R8 and R9 to give a 1000:1 ratio. Resistors R303 and R304 are deposited on a substrate to provide good thermal tracking which keeps the division ratio constant with temperature and self-heating. The substrate is mounted in a milled aluminum can for heat dissipation and must be replaced as a unit.

### 3-69. Buffer Amplifier

3-70. A unity gain amplifier (U12) is used to drive the coaxial cable carrying the divided signal to the 5200A. During instrument overload, input to the Buffer Amplifier comes from the 10:1 divider amplifier in the overload circuit. R14, R15, C14 and C15 provide frequency compensation for the divider and buffer network.

## 3-71. OVERLOAD CIRCUITS

### 3-72. Slew Rate Sense Amplifier

3-73. If the difference in the slew rate voltage between the input amplifier rate and an output sample rate exceeds a voltage detected by a differential amplifier (125 mV) a trigger is provided to the one-shot multivibrator, putting the instrument into overload. The input signal is taken from the emitter of Q148, divided 10:1 by R110 and R109 and applied to one input of the differential amplifier Q104. The other input to Q104 is a sample of the output as developed across R108 and R111 and coupled from the sense line by C91. Q105 is a 5 mA current source, provided 2.5 mA to each side of the differential amplifier. Q103 and Q106 each provide 3.75 mA to the collectors of the differential amplifier. As a result both Q101 and Q102 are biased off, as long as the differentil is balanced. When the differential input to the amplifier reaches 125 mV either Q101 or Q102 turns on and provides an input to the one-shot multivibrator Q92 and Q93, thereby, putting the instrument into the overload mode.

### 3-74. One-shot

3-75. In the one-shots quiescent state, Q92 is conducting the Q93 is cut off. When triggered by the slew rate sense amplifier a 5 Volt pulse is provided from the collector of Q93 to the gate drive circuit for a 4 ms period.

### 3-76. Gate Drive

3-77. Transistors Q37, Q42, Q43, Q44 and their associated components comprise the Gate Drive circuit. When the one-shot is triggered the resulting pulse turns on Q42 and Q37, enabling the gate of the FET switch Q7 and connecting the 10:1 divider to the buffer amplifier. Q43 is turned on from Q42 which turns off the input FET switch and removes the input signal from the input amplifier. Q43 can also be turned on from the Logic circuit (Q45) to prevent the input signal from reaching the input amplifier when the instrument is in standby.

### 3-78. 10:1 Divider Amplifier

3-79. With the instrument in overload it closes the loop back to the 5200A, preventing the 5200A control loop from developing large errors when there is no feedback signal from the 5215A. Gain of the amplifier, U7, is set by the ratio of R7 (5.23k) to R6 (49.9k) which equals 0.105. Application of the amplifier to the buffer amplifier is controlled by the 5200A FET switch.

### 3-80. 5200A FET Switch

3-81. When an overload condition enables the gate drive the 5200A FET switch Q7 is turned on, providing a path for the 10:1 divider amplifier output to the 1000:1 divider network. This low impedance output overrides the signal from the 1000:1 divider network, closing the loop to the 5200A. When the overload is removed the FET switch will automatically turn off after a 3.5 ms delay.

## 3-82. LOGIC CIRCUITS

3-83. These circuits provide the decoding logic for the control inputs and supply the status output to the Logic PCB. Input is the $\overline{\text{5205 OPERATE COMMAND}}$ to set the mode of operation. Status signals output are called OVERDRIVE, $\overline{\text{NEG HV}}$ and $\overline{\text{OVERLOAD}}$.

### 3-84. Logic Control

3-85. The $\overline{\text{5205 OPERATE COMMAND}}$ is low for operate, activating half of U51. with the coupler transistor on, both Q45 and Q43 will be off, allowing the Input FET switch to turn on and the instrument to go into operate.

3-86. When an overload condition exists Q37 in the Gate Drive circuitry turns on, turning on Q40 and activating half of the coupler U52. With the coupler transistor on. $\overline{\text{OVERLOAD}}$ goes low, providing a status output to the logic PCB.

3-87. ±1700V Comparator

3-88. The output voltage is sampled and divided by R59 (9.53m) and R67 (56.2k) then applied to one input of the comparators U64 and U65. A +10V reference from the divider R63 and R64 is applied to the other input of U64. Divider R66 and R65 supply a -10V reference to comparator U65. As long as the output voltage is less than ±1700 Volts the outputs of both U64 and U65 stay high allowing current to flow in Q62 and U62, and in U52, provided the output of U167 is low. When the output exceeds ±1700 the appropriate comparator output goes low, turning off Q62, U62 and U52. With no current flow in U52 and U62 the OVERDRIVE and $\overline{\text{NEG HV}}$ logic signals to the Logic PCB go high, setting the $\overline{\text{NEG HV}}$ logic signals to the Logic PCB to high, setting the instrument to Standby and opening the input FET switch. With no input the output should drop to zero and Q62 turn on again for a normal overload. If the overload remains after one second it is an indication of a malfunction and a fault results.

3-89. Negative High Voltage Sensor

3-90. The negative high voltage is sampled by the divider R170 through R174 and R167 and applied to one input of the comparator U167. The other input has a +5 Volt reference from the zener VR166 and the divider R157, R154 and R156. As long as the negative high voltage is more negative than -2225 Volts the output of U167 is low and current flows through the coupler U52. If the output becomes less negative than -2225 a high output results at the coupler U52, setting the instrument to standby.

3-91. +15V Power Supplies

3-92. A 31V rms input from the Auxiliary power supplies is rectified by CR70 to produce ±20V unregulated. This is filtered by C70 then Q79 is a series pass to reduce it to +15V dc. The +15V is sampled by the divider R80, R81 and R82 and compared to the reference in U79. Any difference between the reference and the sample is amplified by U79, driving the base of Q79 to keep the output at +15 Volts. R79 is the current sense resistor which allows U79 to limit the output current to 160 mA.

3-93. the -15 Volts is obtained from the unregulated supply through the filter C71 and the series pass transistor Q76. The +15 is used as a reference and is connected to the op amp U75 through R73. The -15 is connected to U75 through R74 and since both resistors have the same value the input to the amplifier at the R73/R74 tie-point is zero when the negative output is -15 Volts. Any difference will be applied to the base of Q76 to return the negative output to -15 Volts. Q77 is a current limiter to hold the maximum output current to 80 mA.

## 3-94. Power Amplifier Assembly

3-95. The Power Amplifier, as shown in Figure 3-3, is basically a class AB push-pull type amplifier. The upper tubes (V1 and V2) are connected in parallel to provide sufficient output current capability for the positive portion of the output. The Lower tubes (V3 and V4) are connected in the same manner for the negative portion of the output. The low output impedance in the output stage is achieved by using a complementary emitter-follower output driven by the Input FET Q4. Bias is provided by a network consisting of Q8 and its associated components. The upper tubes have their screen and control grids indirectly connected to the output terminals so the cathode output of the tubes is always slightly higher than the output voltage. This protects the drain of the input FET (Q4) and the collector of the NPN half (Q11) of the complementary emitter follower in the output stage. As a result, the voltage from the output terminal to the tube cathodes is in the range of 5 to 40 volts, which provides adequate breakdown protection for the solid state components. The Lower tubes and the Lower tube driver (Q150) are controlled by an auxiliary feedback loop, using the light coupler (U165). The purpose of this loop is to control the base to collector voltage of the PNP half of the emitter-follower (Q12) to approximately 5 Volts. This has been accomplished by arranging the feedback so that current through the 30 mA current source (Q14) remains constant, which provides the input to the zener VR15, which in turn sets the 5 Volts for Q12 in the output stage. As long as the output capability of the amplifier is not exceeded and current flows in the 30 mA current source the circuit is able to hold the Q12 base-to-collector voltage almost constant.

3-96. The signal path through the circuit is detailed in the following procedure. It is assumed that the LED loop is stabilized with 30 mA of current through the LED prior to an input signal. When a small negative voltage is applied to the circuit as an input the FET Q4 acts as a source follower and translates the change in voltage directly to the base of the output followers Q11 and Q12. The immediate response is to decrease the current in Q11 and increasse it in Q12, as determined by the output load. Since the loop is stabilized the plates of the V3/V4 combination are an extremely high impedance, the increasing current in Q12 flows into the emitter of the LED driver Q14, decreasing the current through the LED. As a result, the current in the PIN half of the

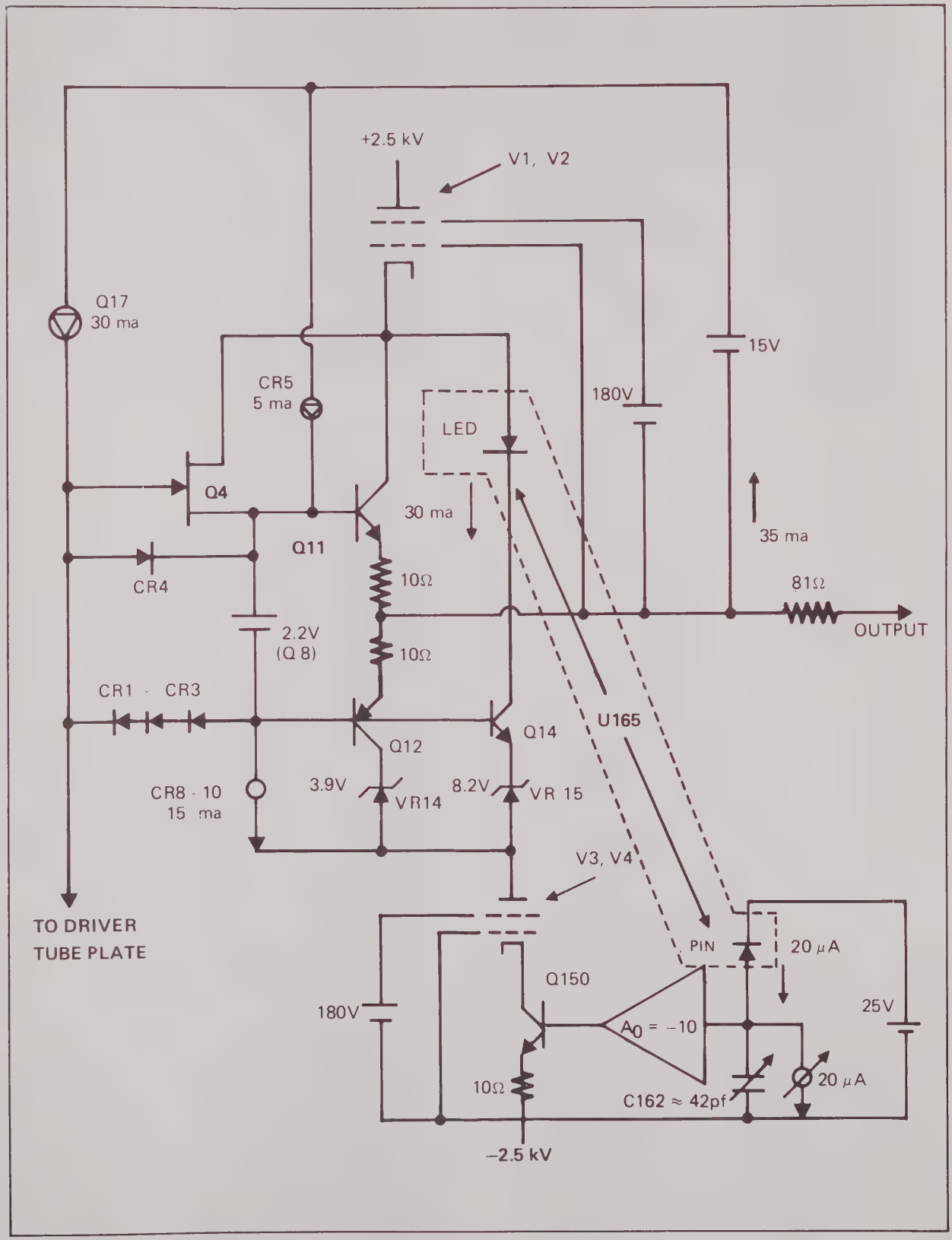



Figure 3-3. SIMPLIFIED POWER AMPLIFIER SCHEMATIC DIAGRAM

coupler is decreased and the net input current to the amplifier $A_0$ is negative. This slews the input node capacitance of approximately 42 pF negative, resulting in a positive output at the base of Q150, which is effectively connected in cascade with the V3/V4 combination. This increases the plate current through V3/V4, which tends to return the current through Q14 to its nominal 30 mA value. The total current excursion in the LED diode is proportional to the time derivative of the total negative tube current. With the approximate transfer ratios and circuit values shown in the simplified schematic (Figure 3-3) the bandwidth of the light coupled loop is approximately 2.5 MHz. In actual usage the loop bandwidth is set to 2.5 MHz by adjusting C162 for 30 mA peak-to-peak in the LED with a 100 ohm load at 100 kHz.

3-97. In normal operation the nominal 2.2V dc bias (Q8 and associated components) between the bases of the complementary output followers is adjusted so that 30 mA of current is flowing through Q12 and 65 mA through Q11. The extra 35 mA in Q11 is required to provide the current used by the current sources Q17 and CR5. The current in thse sources does not return to the output mode of the amplifier but ends up flowing through the driver tube plate and the plates of the negative drive tubes. When the output load requires a very small current excursion the amplifier remains in a class A configuration with both Q11 and Q12 slightly on. As the output current raises in the positive direction the current through Q12 decreases and is completely cutoff when the output exceeds +60 mA. For more positive current all the remaining current necessary comes from Q11 and the positive drive tubes V1/V2. Conversely, Q11, is cutoff for negative output currents in excess of 130 mA and the current is provided from Q12 and the plates of the negative drive tubes V3/V4.

# Section 4
# Maintenance

**WARNING!**

**THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.**

## 4-1. INTRODUCTION

4-2. This section contains information on General Maintenance, a Performance Verification test, a Calibration procedure and Troubleshooting information. The calibration procedure should be performed on a periodic basis (90 days) to detect the need for and to make required adjustments. The performance verification test can be used upon receipt of the 5215A and any other time desired to verify the correct operation of the equipment. The troubleshooting procedures will aid in the isolation of a fault to a particular PCB assembly and further, to a circuit or particular section of the PCB.

## 4-3. SERVICE INFORMATION

4-4. Each instrument that is manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located at the front of the manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various world-wide locations. A complete list of domestic service centers is located in Section 7 of this manual. Shipping information is given in Section 2. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

## 4-6. GENERAL MAINTENANCE

### 4-7. Cleaning Instructions

4-8. Periodically (at least every 90 days) clean the 5215A to remove dust, grease and other contaminants using the following procedure:

a. Insure power is removed from the 5215A.

b. Remove the top and bottom covers and the internal top covers from the power supply and instrument compartments.

c. Remove the air filter from the rear of the fan compartment. Clean the filter using either low pressure clean dry air or a water and mild detergent solution.

d. Clean the interior of the 5215A using low-pressure clean dry air or a vacuum cleaner.

e. If required, clean the PCB assemblies by spraying them with anhydrous ethyl alcohol to loosen the dirt and then removing all residue with low pressure clean dry air. Allow at least six hours for drying time before reapplying power to the 5215A.

Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or a soft cloth dampened with a mild solution of detergent and water.

## 4-9. Fuse Replacement

4-10. Listed below are the correct replacements for the Line Power Fuses. Use only the correct rating as a replacement, dependent upon the supply voltage:

a. Line voltage 100 or 115 volts:

High Voltage—MDA 15 amp
Aux Power—MDA 5 amp

b. Line voltage 200 or 230 volts:

High Voltage—MDA 8 amp
Aux Power—MDA 2 amp

## 4-11. Line Voltage Selection

4-12. The 5215A can operate from any one of four possible line voltages. Selection between 100, 115, 200, or 230 is performed by a combination of jumper positionings which may be changed locally if required. The jumpers may be set to the desired configuration using the procedure given in Section 2 under the heading of Input Power.

CAUTION!

**Lethal voltages of up to ±4000V are present within the instrument for up to 30 sec after power is removed from the system. Extreme caution should be exercised any time that the inner covers are removed from the instrument for servicing.**

## 4-13. Lamp Replacement

4-14. The indicators on the 5215A consists of both incandescent lamps and Light Emitting Diodes (LEDs). If replacement is required, use the following procedures:

4-15. INCANDESCENT LAMP REPLACEMENT

a. Insure power is disconnected from the 5215A.

b. Remove the top cover.

c. The INSTRUMENT ON and OPERATE indicators are dual incandescent lamps mounted on individual plug-in assemblies. To remove, reach down in the space between the front panel and logic board and grasp the desired PCB and remove by pulling straight up.

d. Replace the defective lamp and reassemble the instrument in the reverse order.

4-16. LED REPLACEMENT

a. Insure power is disconnected from the 5215A.

b. Remove the POWER knob on the front panel from its shafts using a 0.050 allen type hex wrench.

c. Remove the top cover and the front three screws from the bottom cover.

d. Remove the five screws on each side from under the side decals that secure the front handles and front panel to the mainframe.

e. The front panel is now free to be removed away from the logic PCB for access to the LEDs.

f. Remove the LEDs requiring replacement from the extension sockets and replace.

g. After replacement reassemble the 5215A in reverse order.

## 4-17. Access to the Mainframe PCB Assemblies

4-18. PRELIMINARY PROCEDURES

4-19. The following procedure should be performed prior to removing any PCB from the instrument.

a. Disconnect both line power cords from the line power source.

b. Extremely hazardous voltages are present within the instrument for up to 30 sec after removal of power. Wait for at least this period before continuing.

c. Remove the top outer cover from the instrument.

d. As a safety precaution, insure no stray voltages are present in the power supply, shorting TP501 to TP502, TP504 to TP506 and TP505 to TP506. These test points are on the power supply PCB and their locations are shown in Figure 4-1.

e. Proceed to the paragraph pertaining to the particular PCB to be removed.

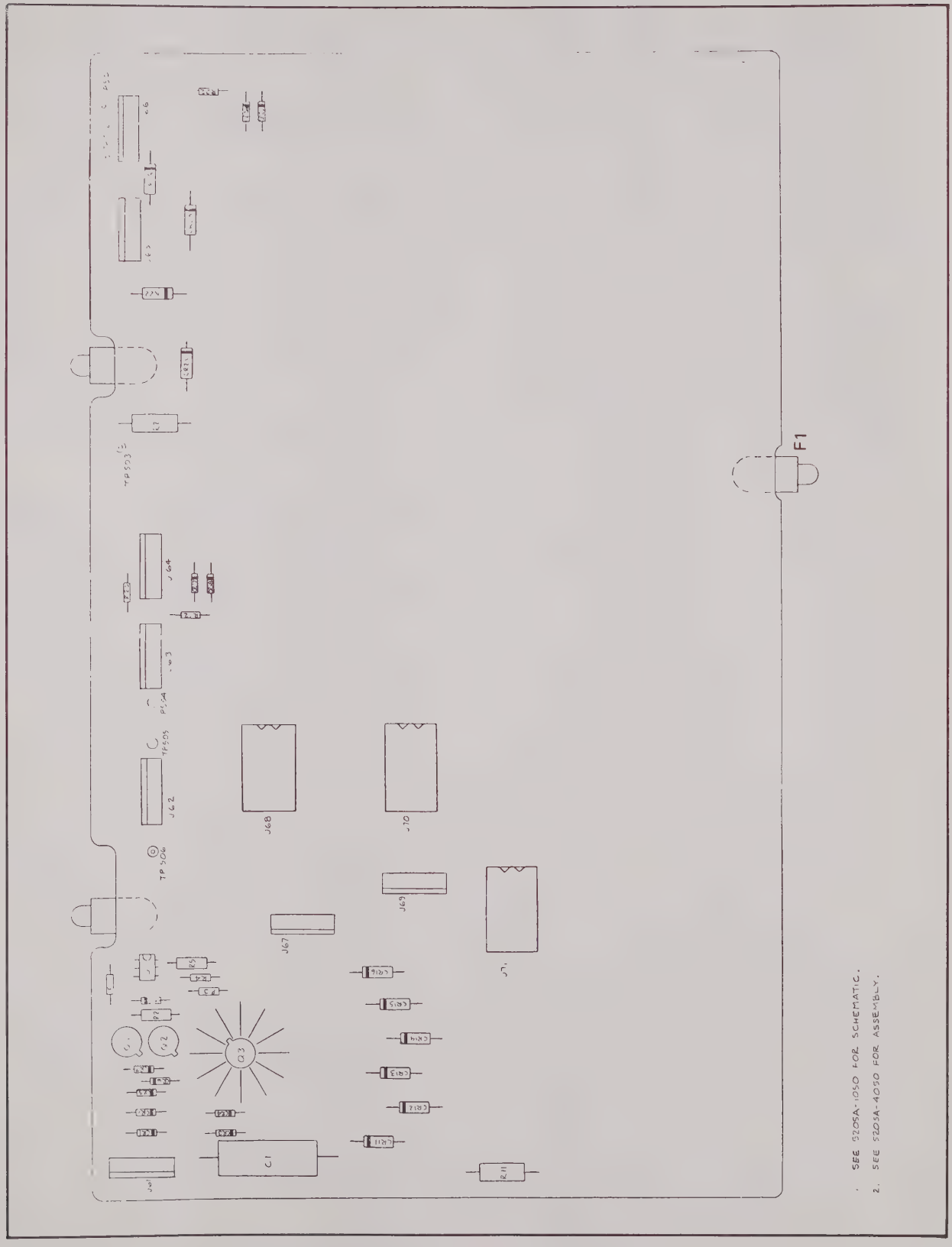



Figure 4-1. POWER SUPPLY TEST POINT LOCATIONS

4-20 POWER SUPPLY ASSEMBLY REMOVAL

a. Remove the transformer cover from the left side of the instrument.

b. Disconnect the Molex connections from the transformer and power wiring.

c. Grasp the plastic retainers and gently rock the PCB while moving it upward. Once free of the motherboard, lift it out of the instrument compartment.

d. Reverse the procedure to replace the PCB.

4-21. PREAMPLIFIER ASSEMBLY REMOVAL

a. Remove the Tube Chamber and Power Amplifier covers from the right side of the instrument compartment.

b. Remove the right side panel by removing the screws, then grasp firmly at each end and pull straight up.

c. Remove the shield over the preamplifier assembly by removing the screws and gently lifting it off.

d. Disconnect the two coaxial connectors (J25, J26) from the upper front of the assembly.

e. In the tube chamber disconnect the coaxial cable center conductor and cable shield connectors. These leads connect the preamplifier to the power amp. They should be removed by grasping the connector with a pair of pliers and pulling straight out, toward the front of the instrument.

f. On the Power Amp Upper Tube PCB remove the four screws that retain the Sense cable coming from the preamplifier.

g. Grasp the plastic retainers and gently rock the preamplifier assembly while moving it upward. Once free from the motherboard lift it out of the instrument compartment.

h. Reverse the procedure to replace the assembly.

4-22. POWER AMPLIFIER ASSEMBLY

a. Remove the tube chamber and Power Amplifier chamber covers from the right side of the instrument compartment.

b. In the Preamplifier tube chamber remove the Coaxial cable center conductor and cable shield connections. These leads connect the power amplifier to the preamplifier. They should be removed by grasping the connectors with a pair of pliers and pulling straight out, toward the front of the instrument.

c. On the Upper Tube Assembly remove the four screws that connect the output cable to the PCB. Repeat the procedure for the sense cable to the preamplifier.

d. Disconnect the molex connector on the Upper Tube PCB going to the Low Capacity Transformer.

e. Grasp the plastic retainers and gently rock the assembly while moving it upward. Once free from the motherboard lift it out of the instrument compartment.

f. If required, the assembly can be broken down to its individual PCB's. The Upper tube PCB (5205A-4030) is connected to the Lower tube PCB (5205A-4031) and the Tube Mounting Assembly (5205A-4033) with screws along the edge. The Lower Tube PCB is connected to the tube mounting assembly with screws to conducting spacers permanently attached to the tube mounting assembly.

g. Reverse the procedure to replace the assembly.

*NOTE*

*The top inner covers have labeled adjustment ports to facilitate the calibration procedure. All calibration points can be reached through these ports. For troubleshooting, the right side cover and front panel can be removed for easy access to the preamp and logic PCB's respectively.*

## 4-23. Access to the Logic PCB Assembly

4-24. Use the following procedure for access to the logic PCB assembly.

a. Insure power is disconnected from the 5215A.

b. Remove the POWER knob on the front panel from its shaft.

c. Remove the top cover and the front three screws from the bottom cover.

d. Remove the five screws on each side, from under the side decals, that secure the front handles to the front panel.

e. Move the front panel away to gain access to the logic PCB. Insure the output cable has sufficient slack to lay the front panel down flat on the work area.

f. Remove the seven screws connecting the PCB to the mainframe and carefully remove the PCB.

g. Reverse the procedure to replace the Logic PCB.

## 4-25. PERFORMANCE VERIFICATION CHECKS

### 4-26. Introduction

4-27. The following paragraphs contain a performance verification procedure. These tests may be used as an acceptance test upon original receipt of the equipment, to verify calibration at any time prior to a scheduled calibration cycle or as an aid in troubleshooting.

4-28. The test equipment required for the performance test is listed in Table 4-1. If the recommended equipment is not available replacements with equivalent specifications may be used. In addition to the test equipment recommended in Table 4-1, accessory items required to check the performance of the 5215A are listed in Table 4-2. These are common items which may be easily obtained or fabricated locally.

### 4-29. Performance Test

4-30. Prior to shipment each 5215A is adjusted at the factory against a reference 5200A so that the amplitude error due to the 5215A is less than approximately 0.01%. If the 5200A used in this procedure is within specifications the 1000 Volt Range will meet the accuracy specification.

4-31. Connect the previously calibrated 5200A to the 5215A using the special interconnect cable (P/N 341560) provided with the 5215A Accessory Pack. Perform each step of the test in turn using the following procedure:

a. Insure the strap connecting the 5215A OUTPUT LOW and chassis ground terminals is firmly in place.

b. Initial 5215A Switch Setting

POWER: ON (30 sec warmup period elapsed)

*NOTE*

*The equipment should have a warmup period of at least one hour prior to performing the test.*

Table 4-1. TEST EQUIPMENT

| | |
|---|---|
| Test Oscillator | Fluke Model 5200A (Calibrated within 90 days) |
| RMS Differential Voltmeter | Fluke Model 931B |
| Thermal Transfer Standard | Fluke Model 540B |
| Coaxial Thermal Converter | CPD Engineering (Formerly Holt Instrument Laboratories) Model 11. Only the thermoelement (PN 90081C), the Resistor Assy (PN 90080E) and the Transfer Switch Assy (PN 85072) are required from the Model 11 series to perform these tests. |
| Digital Voltmeter (5½ digit) | Fluke Model 8800A |
| Digital Voltmeter* (Battery Operated) | Fluke Model 8000A or 8600A |
| DC Calibrator | Fluke Model 332D or 335D |
| Oscilloscope* | Tektronix Model 7403 with 7A18 Amplifier, 7B52 Dual time base, P6042 DC Current Probe<br>100:1 1500V rms rated Voltage probe<br>10:1 500V rms rated Voltage probe |
| Autotransformer* | Variac - rated — 18A at 100/115V - 10A at 200/230V |

* Used during Calibration only

Table 4-2. TEST ACCESSORIES

| | |
|---|---|
| 1500 pF capacitive load | Vitramon High Current porcelain capacitor, type VY84C152J (Fluke P/N 447383) |
| 250 pF capacitive load | Vitramon High Current porcelain capacitor, type VY82C251J (Fluke P/N 447391) |
| 100 pF capacitive load | Vitramon High Current porcelain capacitor, type VY81C101J (Fluke P/N 447409) |
| 5000Ω resistive load | 2 Resistors, Wire Wound, 10,000Ω ±5%, 225W Ohmite Type 0916 connected in parallel. |
| 400Ω | 2 Resistors, Wire Wound, 800Ω ±5%, 50W Ohmite Type 0404 connected in parallel. |
| RC Filter* | 1 MΩ ±5%, ¼W carbon comp. resistor connected in series with a 1 uF ±10% 100V mylar capacitor. |
| Jumper PCBS (3 each)* | Used to maintain bias condition with low input line power during calibration. Three are provided with the instrument. Additional or replacement jumpers may be ordered using Fluke part number 400762 (Drawing 5205A-3080). |
| Insulated Triming Tool* | Rated at 4 kV minimum – Recommended: JFD Adjustment tool 5284, Fluke P/N 153049 |
| Adaptor – Banana Jack to BNC | UG 1094-U Provide Connection between 5200A output and 5205A local input |
| Coaxial Cable | Male BNC connector on each end – not to exceed 6 ft. in length |
| Jumper leads* | Standard leads with alligator clips on both ends for jumpering test points. |
| Thermal Transfer Standard to Thermoelement interconnect cable | Construct an interconnect cable using the listed materials or an equivalent: Connect pin 3 of Amphenol connector 91-MC3M to pin A of connector MS3106A10SL-4S using one lead of Belden type 8422 calbe not exceeding 3 feet in length. Connect the second lead between pins 1 and B respectively of the connectors. Connect the cable shield to the shell of the MS3106A10SL-4S connector. Secure the cable using clamp MS3057-4A. |

* Used during Calibration only.

c. Initial 5200A Switch Settings

POWER: ON (30 sec delay elapsed)
MODE: STDBY
CONTROL: LOCAL
PHASE-LOCK: OFF
SENSE: INT
VOLTAGE ERROR: OFF
VOLTAGE RANGE: 1000V
FREQUENCY RANGE: 10 kHz
VOLTAGE MAGNITUDE: 1000V
FREQUENCY MAGNITUDE: 1 kHz

d. Connect the test equipment as shown in Figure 4-2.

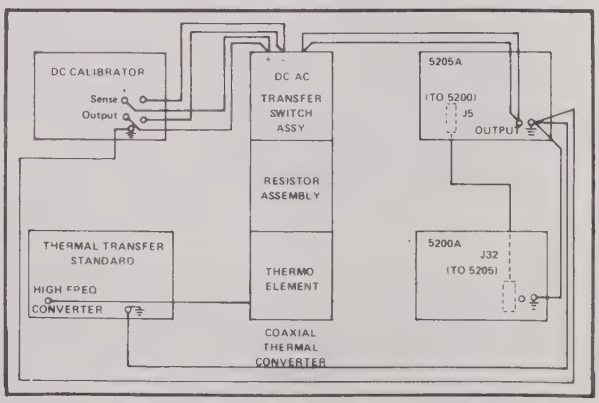



Figure 4-2. CALIBRATOR MODE CONNECTIONS

e. Set the 5200A MODE switch to OPER. Both the 5200A and 5215A OPERATE indicators illuminate.

f. Using the thermal transfer method verify the 5215A output is equal to 1000V ac ±0.042%.

g. Change the 5200A output frequency to 100 kHz on the 100 kHz range.

h. Using the thermal transfer method verify the 5215A output is equal to 1000V ac ±0.11%.

i. Set the 5200A MODE switch to STDBY and the Frequency output to 1 kHz.

j. Wait at least 30 seconds, then apply a 5kΩ/100 pF parallel load to the 5215A output terminals.

k. Repeat steps e through i.

l. Wait at least 30 seconds, then apply a 1500 pF load to the 5215A output terminals.

m. Repeat steps e and f.

n. Set the 5200A MODE switch to STDBY.

o. Wait at least 30 seconds then remove the 1500 pF load and apply a 250 pF load.

p. Repeat steps e, g and h, omitting step f.

q. Set the 5200A Mode switch to STDBY. Wait at least 30 seconds then disconnect the thermal test equipment and the 250 pF load.

r. Connect an RMS differential voltmeter to the 5215A output terminals.

s. Set the 5200A controls for an output of 180V at 100 kHz.

t. Set the 5200A MODE switch to OPER and adjust the rms differential voltmeter for a null reading.

**WARNING!**

**Observe all safety requirements before applying a load to an operating instrument. Do not come in physical contact with the load at any time.**

u. Apply the 1500 pF load to the 5215A output, insuring the deviation from the null does not exceed ±1.05%.

v. Set the 5200A MODE switch to STDBY. Wait at least 30 seconds then remove the applied load and test equipment.

w. Terminate the 5215A output with the 250 pF load.

x. Set the 5200A controls for an output of 1100V at 105 kHz and the 5200A MODE switch to OPERATE.

y. If FAULT and/or OVERLOAD occurs perform the 5215A calibration procedure.

z. Set the 5200A MODE switch to STDBY wait at least 30 seconds then remove the load. This completes the 5215A Performance Test.

## 4-32. CALIBRATION PROCEDURES

### 4-33. General

4-34. The 5215A Calibration procedure should be performed at least every 90 days or any time that a component is replaced. The recommended test equipment and accessories are listed in Tables 4-1 and 4-2. The internal layout is shown in Figure 4-3 while the test point and adjustment locations for the Power Amplifier, Preamplifier and Logic PCB are shown in Figures 4-4, 4-5, and 4-6 respectively.

4-35. Each main division in this procedure begins with a step verifying that all controls and test equipment is in the proper configuration prior to beginning the check. This added precaution is required because of the lethal voltages which can reach 4000 volts internally and 1500V on the output terminals. Since these extremely high voltages are present extra care should be taken to insure that conductive items, such as screwdrivers, pliers or fingers are not inserted into the instrument compartment. Care should also be taken to prevent foreign objects from falling into the instrument since they may decrease the voltage breakdown capability of the inner circuitry. When replacing the top cover or right side panel after adjustments check the inside of the instrument very carefully to insure there are no loose screws, pieces of solder or other objects left behind. Use only non-conductive trimming tools, rated at 4 kV minimum for any internal adjustments.

### 4-36. Oscilloscope Preparation

4-37. MAINFRAME AND PROBE CALIBRATION

4-38. Prior to beginning the 5215A Calibration check the DC zero level on the scope display. Also verify the calibration and AC response of the 100:1 and 10:1 probes when they are connected to the channel on which they are to be used.

4-39. CURRENT PROBE CALIBRATION

4-40. The Tektronix P6042 DC Current probe must be calibrated at zero current each time it is used. Use the following procedure to prepare the current probe for use each time it is connected to the scope mainframe.

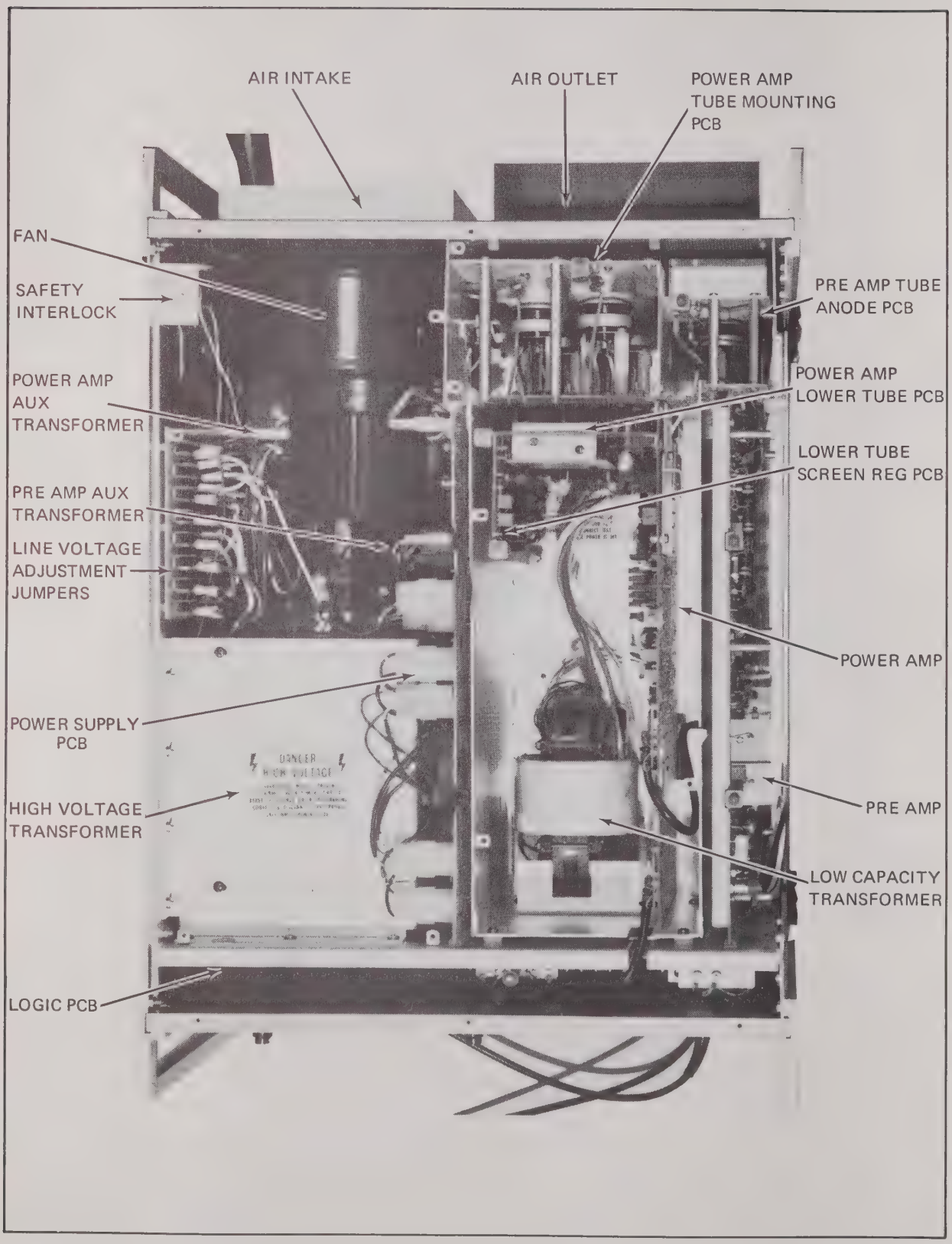



Figure 4-3. INTERNAL LAYOUT

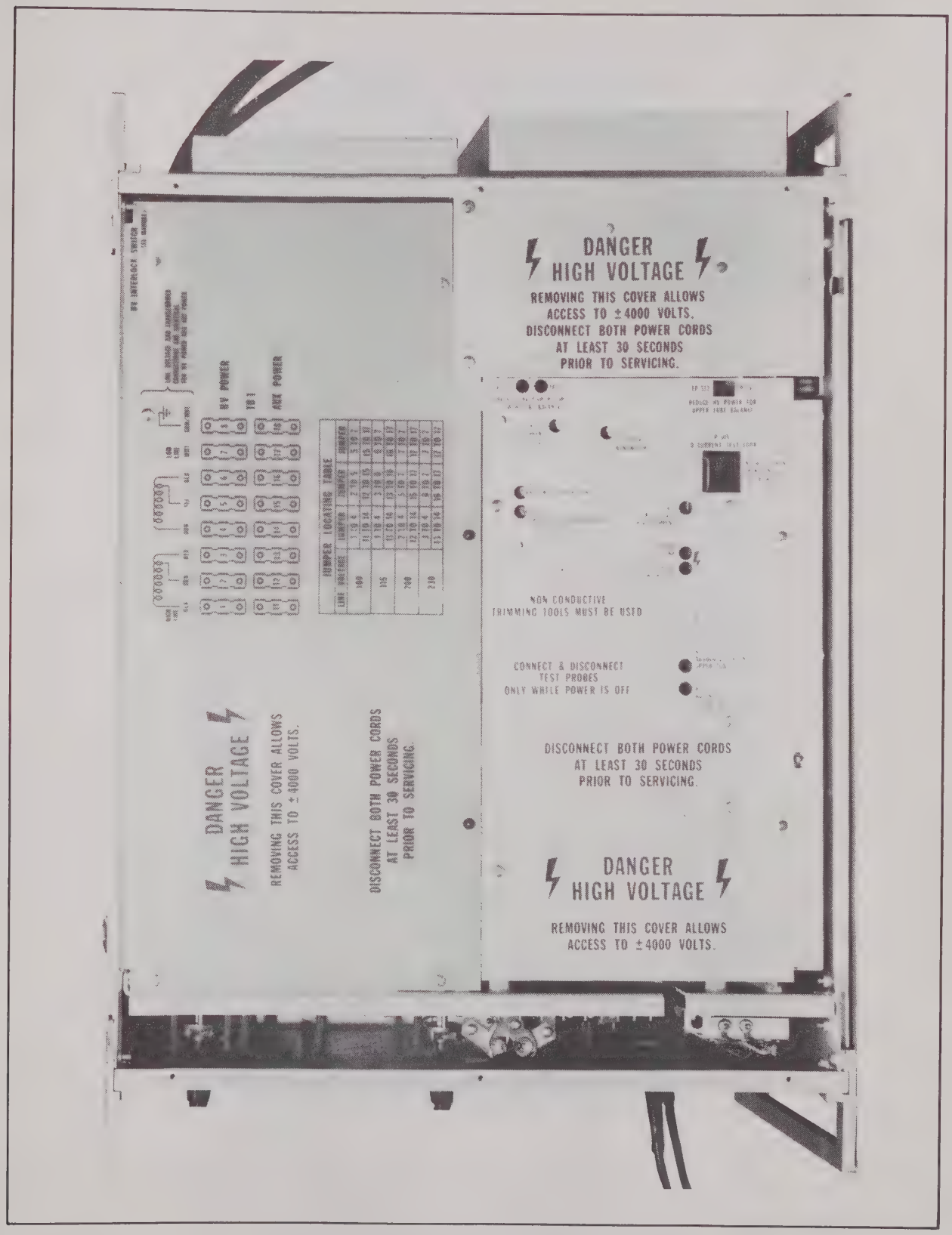



Figure 4-4. POWER AMPLIFIER ADJUSTMENT PORTS

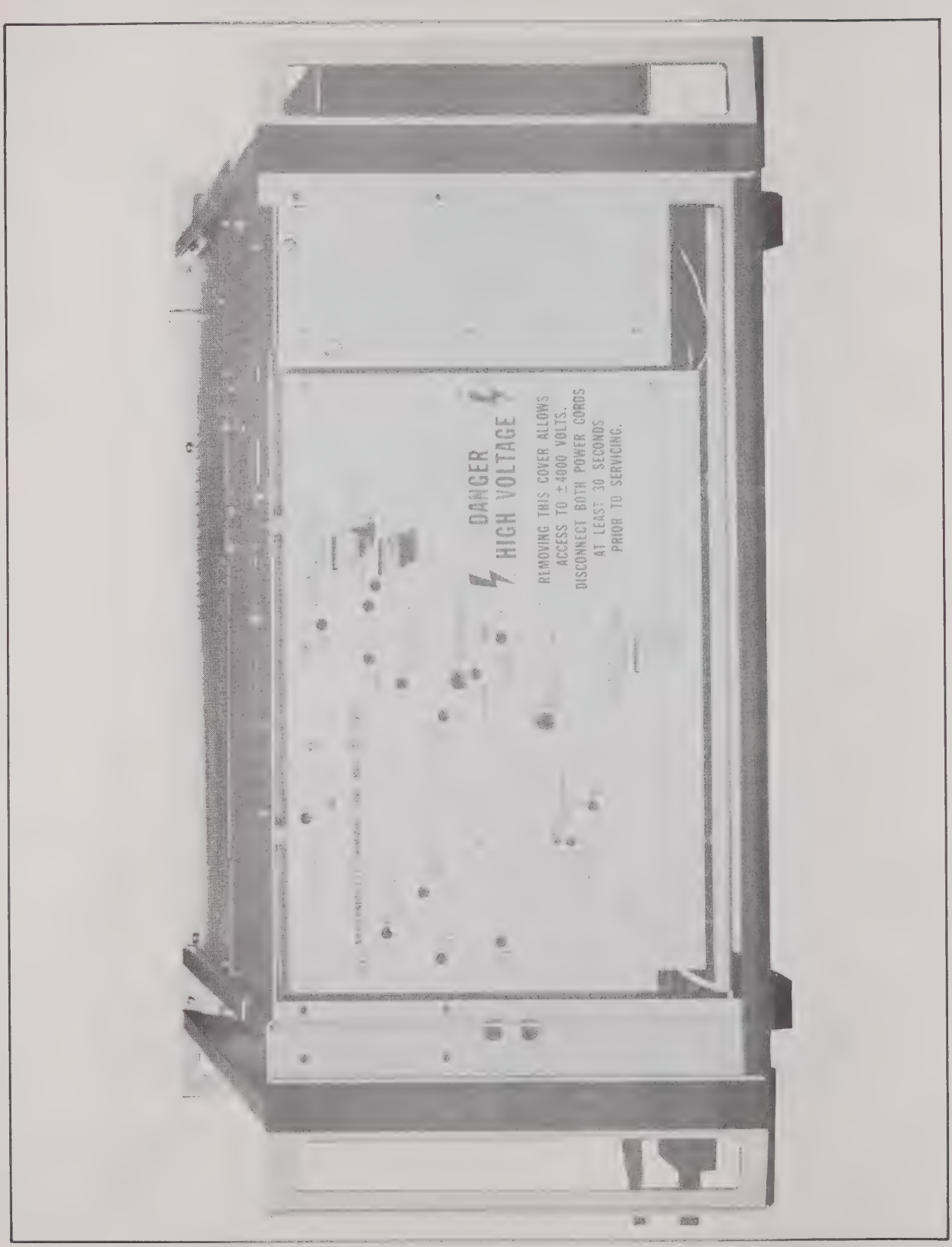



Figure 4-5. PREAMPLIFIER ADJUSTMENT PORTS

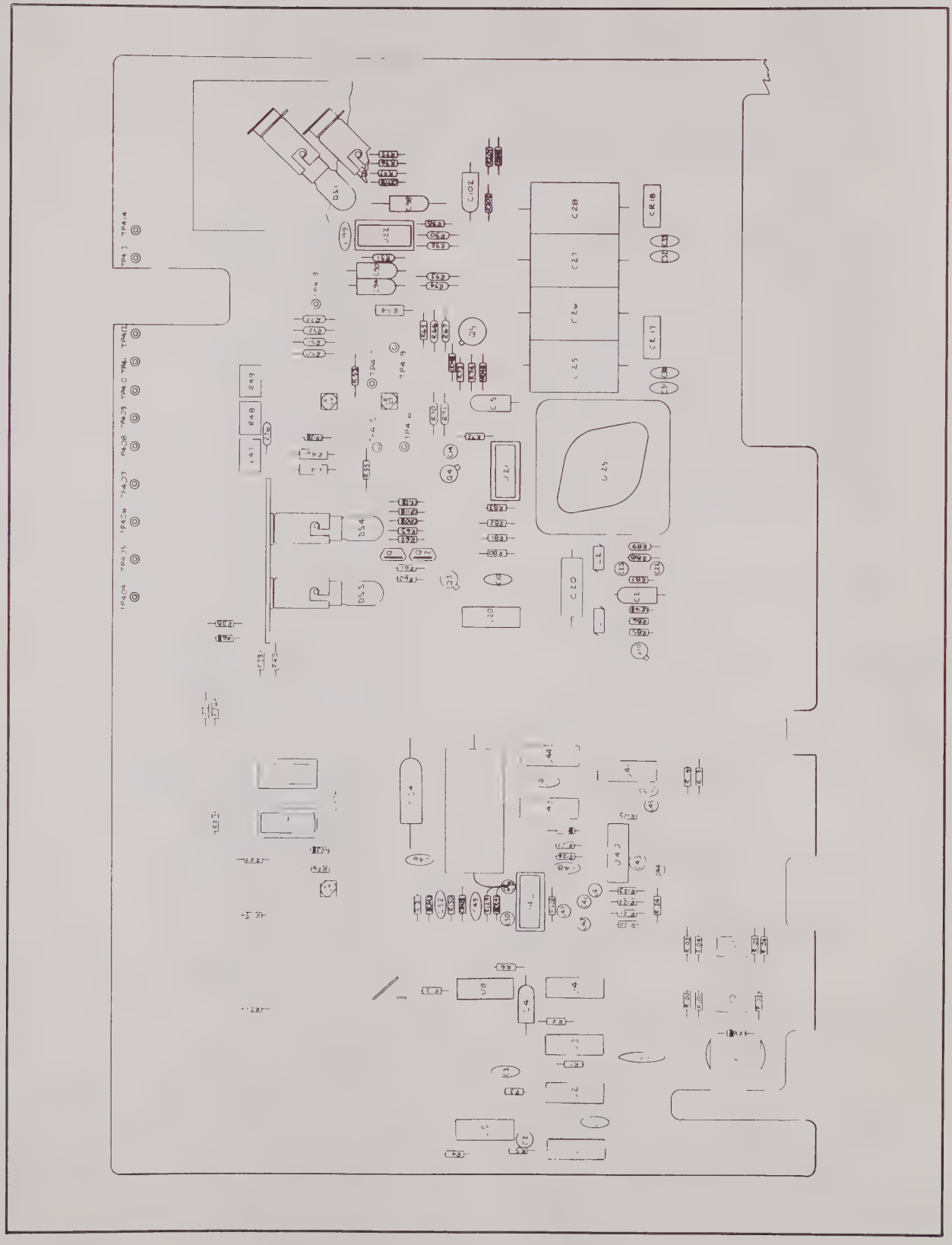


Figure 4-6. LOGIC PCB TEST POINT LOCATION

a. Connect the P6042 output with a 50Ω BNC cable to the oscilloscope, using an HP-10100C 50Ω feed through resistor at the oscilloscope input.

b. Turn on the oscilloscope and current probe power and allow them to warmup for at least five minutes, preferably 30 minutes.

c. Set the oscilloscope controls as follows:
Volts/div—50 mV
Variable (Volts/div)—Calibrated
Input Coupling—Ground

d. Set the Current Probe controls as follows:
Output DC level—Midrange
Current/div Balance—Midrange
Current/div—1A

e. Center the trace vertically on the CRT, then switch the input coupling to DC.

f. Push the thumb-controlled portion of the probe into the locked position;. When the slider is in the locked position the shield around the transformer core is grounded, the PROBE UNLOCKED light is extinguished and the amplifier is ready for operation.

g. Place the probe fully into the front-panel receptacle. Momentarily (200 ms minimum) depress the DEGAUSS lever and release.

h. Adjust OUTPUT DC LEVEL to center the trace vertically on the CRT.

i. Set the CURRENT/DIV switch to the desired position (in most tests it is 10 mA/div) and again degauss the probe.

j. Adjust CURRENT/DIV BALANCE to center the trace vertically on the CRT.

k. Remove the probe from the front-panel receptacle, move the slider back, and place the probe around the conductor under test. Push the slider forward into the locked position. With the oscilloscope deflection factor set at 50 mV/div, the amplitude of the current waveform may be read directly from the front panel of the P6042.

*NOTE*

*The current probe calibration procedure is necessary after initial turn-on and after making current measurements in excess of the dynamic range of the P6042. To degauss, lock the probe and place it in the panel receptacle and press the DEGAUSS lever.*

## 4-41. Equipment Preparation

4-42. Prepare the instrument for calibration using the following procedure:

a. Insure both power cords are disconnected from the AC power line.

b. Connect the previously calibrated 5200A to the 5215A using the special interconnect cable (P/N 341560) provided with the 5215A Accessory Pack.

c. Insure that the POWER switch on the 5215A front panel is OFF.

d. Set the 5200A front panel controls to the following positions:
POWER switch to ON. After the STDBY indicator illuminates, continue.
MODE switch to STDBY.
CONTROL switch to LOCAL
PHASE LOCK SWITCH TO OFF
SENSE switch to INT.
VOLTAGE ERROR switch to OFF
VOLTAGE RANGE at 1000V
FREQUENCY RANGE at 100 kHz
VOLTAGE MAGNITUDE at 100V
FREQUENCY MAGNITUDE of 100 kHz

e. Remove the top cover of the instrument.

f. Remove the right side cover to expose the preamplifier adjustments by removing the seven holding screws and pulling the side cover straight up.

g. Using the shorting link provided insure the OUTPUT LOW and chassis ground terminals are connected and firmly in place (on front panel).

h. Disable the HV interlock by pulling the center rod of the interlock switch up. The interlock switch is located in the left rear corner of the instrument protruding through the transformer compartment cover.

i. Set the autotransformer for zero output.

j. Connect the autotransformer input to the nominal AC line voltage for which the instrument is rated. (Be sure variac is rated for the line voltage and current being used.)

**CAUTION!**

**All test points and adjustments on the preamplifier are accessible through openings in the shields covering the instrument compartments. Do not remove these shields during the calibration procedure. Always be sure to use a non-conductive screwdriver rated to 4 kV to make these adjustments.**

## 4-43. Output Stage Calibration

4-44. A portion of the calibration procedure contained in the following subparagraph is performed with the high voltage line power supply input reduced to 25% of nominal. This reduces the high voltages present in the instrument to approximately 600 volts. The bias states are properly maintained in this condition with a jumper system. This feature lessens the danger associated with calibrating or servicing a potentially lethal instrument. All line power input voltages are given as a percentage of the nominal line voltage for which the instrument is wired.

4-45. The balance readings are or may be at a high potential. The reading should be taken with a floating DVM, that is, a battery operated meter with no connection to ground through the line cord, to reduce common mode measurement errors. Care should be taken that the DVM chassis is well separated from any conducting material to prevent voltage breakdown.

**WARNING!**

**Do not touch the DVM when the 5215A power is on.**

4-46. When the three jumper PCB's are required to maintain bias during operation with less than normal input voltage, insert them in the marked slots in the preamplifier shield.

4-47. Personnel performing the calibration procedure should be aware of the hazardous voltages present and observe good safety precautions at all times.

4-48. OUTPUT STAGE INITIAL SET-UP

4-49. Connect a 100:1 probe to the Oscilloscope input channel. Prepare the oscilloscope to read 5 mV per division (corresponding to 0.5V per division at the probe tip) using DC coupling. Connect the probe to TP307 OUTPUT HIGH TEST through the Power Amp shield. Connect the scope ground lead to chassis.

4-50. Battery Operated DVM: Prepare the DVM to read less than 2V dc. Connect the HI input lead to TP331 and the LO lead to TP332 through the Power Amp shield.

**CAUTION**

**Insure the floating DVM case is well away from all conductive material to prevent short circuits. Although the procedure is safe when performed as described, under extremely abusive conditions a hazardous situation might occur. Verify the probe leads are properly insulated to preclude any shorts or arching to the Power amp shield or chassis.**

4-51. Autotransformer: Set the output to zero volts and connect the power line cord to the nominal line voltage.

4-52. 5215A: Insure the equipment preparation procedure in paragraph 4-41 is complete. Install the three jumper PCBs through the Preamplifier shield. Connect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

4-53. UPPER TUBE BALANCE

**WARNING!**

**Do not touch the DVM with hands or body any time that power is applied to the 5215A.**

4-54. Perform the calibration using the following procedure.

a. Insure the autotransformer output is set to zero.

b. Set the 5215A POWER switch to ON.

*NOTE*

*The INSTRUMENT ON and WARMUP indicators illuminate. After a 30 second delay the WARMUP indicator extinguishes. This time delay occurs each time power is applied to the instrument after it has been removed. If the instrument is set to OPERATE before the time delay expires a FAULT indication results.*

c. After the warmup period raise the autotransformer output voltage to approximately 25% of the nominal line voltage (25% x 115V = 29V).

d. Verify the voltage displayed on the oscilloscope is 0 ± 100 mV at the probe tip (less than ±0.2 division on the display). If the display is greater than ±100 mV the circuit is defective.

*NOTE*

*The above reading is adjusted during the DC OFFSET CALIBRATION later in this procedure. If it exceeds the listed tolerance it is beyond the adjustment range and should be repaired at this time. Use the Troubleshooting procedure in Table 4-3 starting at step 86.*

e. Adjust R33 BALANCE UPPER TUBES for a minimum reading on the DVM. The maximum allowable reading is 0 ±10 mV dc.

f. If the reading exceeds the allowable, remove power, set R35 ABSOLUTE SCREEN VOLTAGES UPPER TUBES to approximately midrange, reapply power, then repeat the test. If the reading still exceeds the allowable, the instrument is defective.

g. Set the autotransformer output voltage to zero, set the POWER switch to OFF and disconnect both power cords. Wait at least 30 seconds for the Power Supply to discharge and disconnect the DVM from test points 331 and 332.

4-55. LOWER TUBE BALANCE

4-56. Make the following equipment changes:

a. Connect the Battery Operated DVM HI input lead to TP333 and the LO led to TP334 through the Power Amp shield.

**CAUTION**

**Insure the floating DVM case is well away from any conductive material to prevent short circuits. Although the procedure is safe when performed as described, under extremely abusive conditions a hazardous situation might occur. Verify the probe leads are properly insulated to preclude any shorts or arcing to the Power amp shield or chassis.**

b. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

**WARNING**

**Do not touch the DVM with hands or body time that power is applied to the 5215A.**

4-57. Perform the calibration using the following procedure:

a. Insure the autotransformer output is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the Warmup period raise the autotransformer output voltage to approximately 25% of the nominal line voltage (25% x 115V = 29V).

d. Verify the voltage displayed on the oscilloscope 0 ±100 mV dc at the probe tip (less than ±0.2 division on the display). If greater than ±100 mV the instrument is defective.

*NOTE*

*The above reading is adjusted during the DC OFFSET CALIBRATION later in this procedure. If it exceeds the listed tolerance it is beyond the adjustment range and should be repaired at this time. Use the troubleshooting procedure in Table 4-3 starting at step 86.*

e. Adjust R112 BALANCE LOWER TUBES for a minimum reading on the DVM. The maximum allowable reading is 0 ±10 mV dc.

f. If the reading exceeds the allowable, remove power, set R109 ABSOLUTE SCREEN VOLTAGES LOWER TUBES to approximately midrange, reapply power, then repeat the test. If the reading still exceeds the allowable the instrument is defective.

g. Set the autotransformer output voltage to zero, set the POWER switch to OFF and disconnect both power cords. Wait at least 30 seconds for the Power Supply to discharge and disconnect the DVM from test points 333 and 334.

4-58. OUTPUT STAGE BIAS CURRENT

4-59. Make the following equipment changes:

a. Connect the Battery Operated DVM HI input lead to TP307 OUTPUT HIGH TEST and the LO lead to TP308 PNP through the Power Amp shield. Both the DVM and Scope HI input leads are now connected to this test point.

CAUTION

**Insure the floating DVM case is well away from any conductive material to prevent short circuits. Although the procedure is safe when performed as described, under extremely abusive conditions a hazardous situation might occur. Verify the probe leads are properly insulated to preclude any shorts or arcing to the Power amp shield or chassis.**

b. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

**WARNING!**

**Do not touch the DVM with hands or body any time that power is applied to the 5215A.**

4-60. Perform the calibration using the following procedure.

a. Insure the autotransformer output is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the Warmup period raise the autotransformer output voltage to approximately 25% of the nominal line voltage (25% x 115V = 29V).

d. Verify the voltage displayed on the oscilloscope is 0 ±100 mV dc at the probe tip (less than ±0.2 division on the display). If the display is greater than ±100 mV the circuit is defective.

*NOTE*

*The above reading is adjusted during the DC OFFSET CALIBRATION later in this procedure. If it exceeds the listed tolerance it is beyond the adjustment range and should be repaired at this time. Use the Troubleshooting procedure in Table 4-3 starting at step 86.*

e. Adjust R7 OUTPUT STAGE BIAS CURRENT for a reading between +220 mV and +240 mV on the DVM.

f. Set the autotransformer output voltage to zero, set the POWER switch to OFF and disconnect both power cords. Wait at least 30 seconds for the Power Supply to discharge and disconnect the DVM from test points 307 and 308.

4-61. LED LOOP BIAS CURRENT

4-62. Make the following equipment changes:

a. Insure the P6042 current probe is calibrated for a zero indication and a current sensitivity of 10 mA/division as described in the Current Probe Calibration procedure.

b. Connect the current probe around TP309 LED CURRENT TEST LOOP with the arrow on the probe pointing to the front of the instrument. Also insure the probe is properly locked and the PROBE UNLOCKED indicator is extinguished as described in the Current Probe Calibration.

c. Set the oscilloscope current channel controls for DC coupling with sensitivity of 50 mV/division.

d. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

4-63. Perform the calibration using the following procedure:

a. Insure the autotransformer output is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the Warmup period raise the autotransformer output voltage to approximately 25% of the nominal line voltage (25% x 115V = 29V).

d. Verify the voltage displayed on the oscilloscope is 0 ±100 mV dc at the probe tip (less than ±0.2 division on the display). If greater than ±100 mV the instrument is defective.

*NOTE*

*The above reading is adjusted during the DC OFFSET CALIBRATION later in this procedure. If it exceeds the listed tolerance it is beyond the adjustment range and should be repaired at this time. Use the troubleshooting procedure in Table 4-3 starting at step 86.*

e. Display the LED Current and carefully adjust R172 LED CURRENT for a display of 30 mA ±1 mA (3 div ±0.1 div).

f. Lower the autotransformer voltage to zero, dropping the LED Current to zero, and verify the current probe zero adjustment.

g. Raise the autotransformer output voltage back to the previous setting of approximately 25% of the nominal line voltage.

h. Verify the LED current is –30 mA ±1 mA. Readjust R172 if required.

i. Set the autotransformer output to zero. Set the POWER switch to OFF and disconnect both Power cords. Wait at least 30 seconds for the Power Supply to discharge then disconnect the voltage and current probes and the three jumper PCB's from the instrument.

4-64. LED LOOP BANDWIDTH

4-65. Make the following equipment changes:

a. Set the Oscilloscope current channel controls for AC Coupling remaining at 50 mV/division sensitivity, then center the trace baseline.

b. Connect the 100:1 probe across the 5215A output terminals. Set the scope controls for DC coupling, 0.5V/division sensitivity (corresponding to 50V at the probe tip) and a Time Base of 2 usec/division.

c. Verify removal of the three jumper PCB from the preamplifier.

d. Disable the ±200 mA current trips on the 5215A Logic PCBs by connecting TP410 ($I_{L+}$) to TP409 (+5V) with a jumper to disable the positive HV supply current trip and TP408 ($I_{L-}$) to TP407 (GND) to disable the negative HV supply current trip.

e. Connect the 400 Ω 100W load resistor across the 5215A output terminals.

f. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

4-66. Perform the calibration using the following procedure:

a. Insure the autotransformer output is set to zero.

b. Set the 5200 magnitude for an output of 113.2V at 100 kHz.

c. Set the 5215A POWER switch to ON.

d. After the Warmup period quickly raise the autotransformer output voltage to 100% of the nominal line voltage.

*NOTE*

*OVERLOAD and FAULT indications will result if the autotransformer output is raised to slowly.*

e. Set the 5200A MODE switch to OPERATE.

f. The scope voltage channel probe displays an 6.4 division peak-to-peak sinusoidal waveform, corresponding to approximately 800 mA p-p output current. Since the gain has not yet been set the magnitude of the display will not be exact.

g. Adjust C162 LED LOOP BANDWIDTH so that the current channel waveform is 30 mA p-p between the positive and negative peaks. The waveform should appear as shown in Figure 4-7.

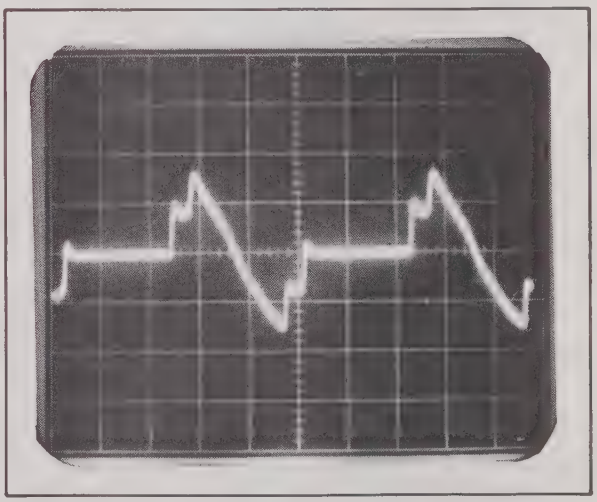


Figure 4-7. LED LOOP CURRENT WAVEFORM

*NOTE*

*The current displayed is essentially proportional to the derivative of the total current drawn by the Power Amplifier lower Output tubes.*

h. Set the 5200A MODE switch to STDBY. Set the POWER switch to OFF and disconnect both power cords. Wait at least 30 seconds for the Power Supply to discharge and disconnect the oscilloscope voltage and current probes from the instrument.

4-67. SCREEN VOLTAGE CALIBRATION

4-68. Make the following equipment changes:

a. Prepare the DVM to monitor the nominal AC line Voltage and connect the input leads across the autotransformer output.

b. Prepare the oscilloscope for operation with sensitivity of 0.5V/division (corresponding to 50V/division at the probe tip), a time base of 20 usec/division and dc coupling.

c. Accurately adjust the oscilloscope probe AC compensation using the oscilloscope calibrator.

d. Set the vertical gain of the oscilloscope by applying 226.28V rms 10 kHz from the 5215A output to the 100:1 input probe. Adjust the scope channel variable gain for a display of exactly 8 divisions peak-to-peak.

e. Disable the 5215A overload circuits by connecting TP18 OVERLOAD DISABLE to TP19 GND (SENSE LOW) with a jumper. The test points can be reached through the Preamplifier shield.

f. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

4-69. Perform the calibration using the following procedure:

*NOTE*

*For correct adjustment of the current limits it is important to check the zero baseline for drift both before and after the procedure. If any drift occurs the procedure should be repeated.*

a. Raise the autotransformer output voltage to nominal plus 10% (110% x 115V = 126.5V).

b. Set the 5200A for an output of 180V rms at 10 kHz.

c. Set the 5215A POWER switch to ON.

*NOTE*

*The 5215A internal power dissipation is very high when it is in the OPERATE mode. Maintain this status only as long as necessary to make the required adjustment.*

d. After the warmup period, set the 5200A MODE switch to OPERATE.

e. Adjust R109 ABSOLUTE SCREEN VOLTAGES LOWER TUBES through the power amplifier shield until the scope displays a waveform where the flat portion of the negative peak is at exactly -240 volts (-3.0 divisions).

f. Check the zero baseline setting the 5200A MODE switch to STDBY and then back to OPERATE. The adjusted peak voltage should remain as set in step e above.

g. Set the 5200A output voltage magnitude to 156V rms.

h. Adjust R35 ABSOLUTE SCREEN VOLTAGES UPPER TUBES through the power Amplifier shield until the scope displays a waveform where the flat portion of the positive peak is at exactly +208 volts (+2.6 divisions).

i. Check the zero baseline by setting the 5200A MODE switch to STDBY and then back to OPERATE. The adjusted peak voltage should remain as set in step h above.

j. Set the 5200A MODE switch to STDBY and the POWER switch to OFF. Set the autotransformer output voltage to zero and disconnect both power cords. Remove the oscilloscope and DVM leads.

4-70. POSITIVE CURRENT TRIP LEVEL ADJUSTMENT

4-71. Make the following equipment changes:

a. Insure a jumper connects TP408 ($I_{L\_}$) and TP407 (GND) on the Logic PCB. Remove the other jumpers previously installed between test points on the Logic and Preamplifier PCB's. The jumper remaining disables the negative current trip while setting the positive trip level.

b. Connect the DVM HI input lead to TP411 (I+) and the LO lead to TP407 (GND) on the Logic PCB. Prepare the DVM to read less than 2V dc.

c. Reconnect the Auxiliary Power line cord to the nominal line voltage and the High Voltage line cord to the autotransformer.

4-72. Perform the calibration as follows:

a. Insure the autotransformer output is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the warmup period, raise the autotransformer output voltage to the nominal line voltage.

d. Set the 5200A magnitude to 114 Volts rms at 100 kHz.

e. Set the 5200A MODE switch to OPERATE.

f. Observe the DVM reading and slowly increase the 5200A output until the 5215A trips into FAULT and drops out of OPERATE.

g. The DVM should read between -210 and -214 mV when it trips. If the DVM reading is within tolerance set the 5200A MODE switch to STDBY, the 5215A POWER switch to OFF, the Autotransformer output to zero and then proceed to the Negative Current Trip Level Adjustment in the following paragraph. If the reading is not acceptable continue with step h of this paragraphs.

h. Reduce the 5200A voltage magnitude to a level less than 114V to prevent a FAULT condition.

i. Rotate R49 fully counterclockwise.

j. Set the 5200A MODE switch to STDBY and then OPERATE.

k. Adjust the 5200A voltage magnitude for a reading on the DVM between -211 and -213 mV.

l. Very slowly rotate R49 clockwise until the 5215A trips into FAULT and drops out of OPERATE.

m. Decrease the output level of the 5200A slightly and reset the FAULT on the 5215A by setting the 5200A MODE switch first to STDBY and then to OPERATE.

n. Slowly increase the 5200A voltage magnitude until the 5215A trips into FAULT, verifying that it occurs between -210 and -214 mV.

o. Set the 5200A MODE switch to STDBY and the 5215A POWER switch to OFF. Set the autotransformer output voltage to zero.

4-73. NEGATIVE CURRENT TRIP LEVEL ADJUSTMENT

4-74. Make the following equipment changes:

a. Reduce the 5200A voltage magnitude to 114V rms, remaining at 100 kHz.

b. Remove the jumper between TP407 and TP408 and connect it between TP410 ($I_{L+}$) and TP409 (+5) to disable the Positive current trip while setting the negative trip level.

c. Transfer the DVM HI input lead to TP412 (I-) on the Logic PCB.

4-75. Perform the calibration as follows:

a. Set the 5215A POWER switch to ON.

b. After the warmup period, raise the autotransformer output voltage to the nominal line voltage.

c. Set the 5200A MODE switch to OPERATE.

d. Observe the DVM reading and slowly increase the 5200A voltage magnitude until the 5215A trips into FAULT.

e. The DVM should read between +210 and +214 mV when it trips. If the DVM reading is within tolerance proceed to the following paragraph. If the reading is not acceptable continue with step f of this paragraph.

f. Reduce the 5200A voltage magnitude to less than 114V to prevent a FAULT condition.

g. Rotate R48 fully counterclockwise.

h. Set the 5200A MODE switch to STDBY then OPERATE.

i. Adjust the 5200A voltage magnitude for a reading on the DVM between +211 and +213 mV.

j. Very slowly rotate R48 clockwise until the 5215A trips into FAULT and drops out of OPERATE.

k. Decrease the output level of the 5200A voltage magnitude just slightly and reset the FAULT on the 5215A by setting the 5200A MODE switch first to STDBY and then to OPERATE.

l. Slowly increase the 5200A voltage magnitude until the 5215A trips into FAULT, verifying that it occurs between +210 and +214 mV.

4-76. The Output stage portion of the Calibration is complete. Set the 5200A MODE switch to STDBY and the 5215A POWER switch to OFF. Set the autotransformer output voltage to zero. Remove any jumpers installed in the instrument. Disconnect both power cords. Wait at least 30 seconds for the power supply to discharge then disconnect the DVM and the Output load from the instrument.

## 4-77. Preamplifier Calibration

4-78. This portion of the procedure contains the information necessary to calibrate the preamplifier section of the 5215A. As in the output stage calibration, all adjustments should be made through the indicated ports in the preamplifier shield. The shield should not be removed at any time since voltages up to 4000V are present within the instrument any time power is applied. Insert the output cable terminal into its safety area any time it is not in use. No jumpers or jumper PCBs are used during this test and should be removed if installed. The shorting link between the front panel OUTPUT LOW and Chassis ground terminals should be installed at all times.

4-79. PREAMPLIFIER INITIAL SET-UP

4-80. DVM: Prepare the DVM to read less than 20V dc. Connect the HI input lead to TP11 +15V and the LO lead to TP19 GND (SENSE LOW).

4-81. Autotransformer: Set the output to zero volts and connect the power line cord to the nominal line voltage.

4-82. 5215A: Insure the equipment preparation procedure in paragraph 4-41 is complete, the 5200A is connected with the interconnect cable supplied and all jumper wires or PCBs are removed from theinstrument. Connect the Auxiliary Power line cord to the nominal line voltage.

4-83. PREAMPLIFIER ±15 VOLT SUPPLY VOLTAGE

4-84. Perform the calibration as follows:

a. Set the 5215A POWER switch to ON.

b. Adjust R82 +15V for a reading on the DVM between +14.95 and 15.05 volts.

c. Move the DVM HI input lead to TP12 -15V.

d. The DVM reads between -14.65 and -15.35 volts. There is no adjustment.

e. Set the 5215A POWER switch to OFF.

f. Remove the DVM test leads.

4-85. MINIMUM NEGATIVE HIGH VOLTAGE TRIGGER LEVEL

4-86. Make the following equipment changes:

a. Prepare the DVM to monitor the nominal line voltage and connect the input leads across the autotransformer output.

b. Set the 5200A controls for an output of 110V on the 1000V range at 1 kHz.

c. Connect the High Voltage line cord to the autotransformer.

4-87. Perform the calibration as follows:

a. Insure the autotransformer is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the Warmup period raise the autotransformer output voltage to the nominal line voltage.

d. Set the 5200A MODE switch to OPERATE.

e. Observe the DVM reading and slowly decrease the autotransformer output until the 5215A trips into FAULT and drops out of OPERATE.

f. The DVM should read between 98.0 and 98.6V ac at the trip point.

g. Set the 5200A MODE switch to STDBY the 5215A POWER switch to OFF and the autotransformer output to zero.

h. If the DVM reading is within tolerance proceed to the Input FET switch Impedance Calibration in the next paragraphs. If the reading is not acceptable continue with the procedure in step i of this paragraph.

i. Rotate R154 HV TRIGGER fully counterclockwise.

j. Set the 5215A POWER switch to ON.

k. After the warmup period, raise the autotransformer output voltage to the nominal line voltage less 14.5% (115V -(115 x 14.5%) = 98.3V).

l. Set the 5200A MODE switch to OPERATE.

m. Slowly rotate R154 clockwise until the 5215A trips into FAULT and drops out of OPERATE.

n. Raise the autotransformer output voltage to the nominal line voltage.

o. Reset the FAULT on the 5215A by setting the 5200A MODE switch first to STDBY and then to OPERATE. The OPERATE indicator illuminates without a FAULT resulting.

p. Set the 5200A MODE switch to STDBY and the 5215A POWER switch to OFF. Lower the autotransformer output voltage to zero. Disconnect the DVM test leads from the autotransformer output.

4-88. OVERLOAD TRIGGER BALANCE CALIBRATION

4-89. Make the following equipment changes:

a. Connect a 10:1 probe to the oscilloscope input channel. Prepare the oscilloscope to read 5 mV/division (corresponding to 50 mV/division at the probe tip) using dc coupling. Connect the probe to TP1 DC BALANCE MONITOR through the preamplifier shield. Connect the scope ground lead to TP19 GND (SENSE LOW).

4-90. Perform the calibration as follows:

a. Insure the autotransformer is set to zero.

b. Set the 5215A POWER switch to ON.

c. After the warmup period, raise the autotransformer voltage to the nominal line voltage.

d. Ground the oscilloscope input channel and set the trace to the middle of the CRT.

e. Remove the ground and adjust R130 DC BALANCE for a minimum display on the CRT, not to exceed 0 ±5 mV.

f. Set the 5200A controls for an output of 1100V rms at 110 kHz.

g. Select AC Coupling on the oscilloscope and move the probe to TP13 OVERLOAD TRIGGER SIGNAL.

**WARNING!**

**Verify the output connector is stored in its safety area in the Front Panel. Dangerous voltages are present at the output terminals during this adjustment.**

h. Set the 5200A MODE switch to OPERATE.

i. Adjust R111 AC BALANCE for a minimum peak-to-peak amplitude as displayed on the CRT.

j. Set the 5200A MODE switch to STDBY and the 5215A POWER switch to OFF. Lower the autotransformer output voltage to zero. Remove the oscilloscope probe from the instrument.

## 4-91. Calibration Point Adjustments

4-92. This section of the Calibration Procedure contains the steps required to set the calibration points. It is assumed that calibration of the output stage and preamplifier have already been completed.

4-93. When this portion of the procedure is performed, it should be done in conjunction with the 5200A with which the 5215A is normally used. Also, the 5200 should be calibrated immediately preceding the 5215A.

*NOTE*

*If the 5215A is calibrated with one 5200A and used with a different 5200A, it is possible it will not meet specifications.*

4-94. Steps in the following procedure must be performed in sequence. If a readjustment of any previous step is required, the entire procedure should be repeated, starting at the beginning. During the procedure the jumper PCBs are not installed and no jumpers between test points used. Also, the autotransformer is not used, both power cords are applied directly to line power.

4-95. DC OFFSET

4-96. Prepare the equipment for the test as follows:

a. Insure the 5215A POWER switch is ON and the shorting link connecting the front panel OUTPUT LOW and chassis ground terminals is installed and firmly in place.

b. Verify the 5200A controls are set for an output of 100V on the 1000V range at 100 kHz.

*NOTE*

*The 5215A should have power applied continuously for at least one hour prior to beginning the following procedures.*

c. Prepare the test DVM to read DC volts on its most sensitive scale, i.e., a resolution of at least 100 uV.

d. Connect the equipment as shown in Figure 4-8.

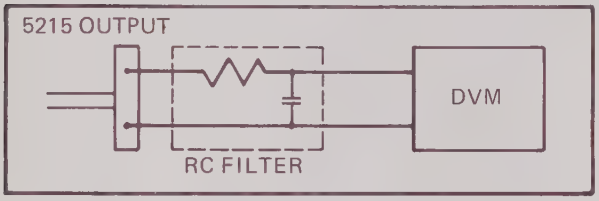



Figure 4-8. DC OFFSET TEST CONNECTIONS

4-97. Perform the calibration as follows:

a. Verify the one hour minimum warmup period for stability has elapsed.

b. Set the 5200A MODE switch to OPERATE.

c. Adjust R123 DC OFFSET for an output voltage of 0 ±1 mV.

d. Set the 5200A MODE switch to STDBY.

4-98. LOW AND HIGH FREQUENCY GAIN ADJUSTMENT

4-99. Prepare the equipment for the test as follows:

a. Connect the equipment as shown in Figure 4-2.

b. Set the 5200A controls for an output of 1000V rms at 1 kHz.

4-100. Use the following procedure to calibrate the low and high frequencies gain.

a. Set the 5200A MODE switch to OPERATE.

b. Perform the transfer test, adjusting R9 5200A LF GAIN (1 kHz) for a transfer standard null at 0 ± 0.01% taking the correction factor into account.

c. Remaining in the 1000 Volt range set the 5200A output frequency to 100 kHz.

d. Perform the transfer test, adjusting C14 5200A HF GAIN (100 kHz) for a transfer standard null at 0 ± 0.01% taking the correction factor into account.

e. Set the 5200A MODE switch to STDBY.

f. Set the 5200A and 5215A POWER switches to OFF and disconnect the test equipment.

## 4-101. Interconnect Cable

4-102. An interconnect cable for use during the calibrator mode is supplied with each 5215A. The cable connects J32 on the rear of the 5200A to the connector labeled 5200A on the rear of the 5215A. A diagram of the pin connections is shown in Figure 4-9.

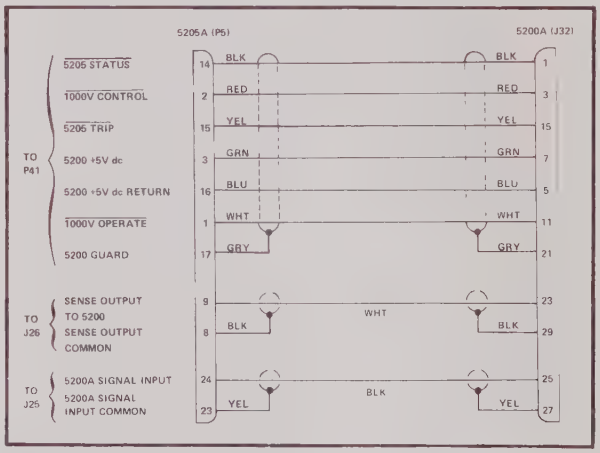



Figure 4-9. CALIBRATOR MODE INTERCONNECTIONS

## 4-103. Logic Trip Adjustment

*NOTE*

*This setting monitors the logic supply voltage and is adjusted at the factory. It should not require normal calibration, however, adjustment could be required if drift within the circuit is sufficient to trip the instrument into FAULT.*

4-104. If required, adjust the logic trip circuit using the following procedure:

a. Verify that there are no jumpers PCBs or jumpers installed in the 5215A and both power cords are connected to the line source.

b. Connect the DVM HI input to TP409 (+5) and the LO input to TP407 (GND). Prepare the DVM to read +5V dc. Both test points are located on the logic PCB.

c. Connect a jumper between TP418 and TP417. (Located near the FAULT and OVERLOAD indicators on the Logic PCB.)

d. Set the POWER switch to ON and wait 30 sec for the warmup period to expire.

e. The DVM should read between 4.75 and 5.25 Volts dc.

f. Rotate R47 fully clockwise and then very slowly adjust until the fault indicator extinguishes.

g. Check at high and low line voltage limits (nominal ±10%) and the Logic circuits +5V is between +4.75 and +5.25V dc and the instrument does not trip into FAULT.

h. Set the POWER switch to OFF and disconnect the test equipment and jumper.

## 4-105. TROUBLESHOOTING

4-106. Troubleshooting for the 5215A consists of the tabular flow chart in Table 4-3. When a step on the flow chart is completed check for a decision transfer. If no decision is required perform the next step of the table in sequence.

**WARNING!**

**Lethal voltages up to 2.5 kV are present within the instrument during troubleshooting. In addition, the voltage may be present for up to 30 seconds after power is removed from the instrument. Before coming into physical contact with any component use a voltmeter and 5 kV probe to insure there is no voltage, present between TP502 (+2.5 kV) and TP503 (LO), between TP504 (-2.5 kV) and TP506 (LO), and between TP505 (-2.5 kV) and TP506 (LO). All test points are on the Power Supply PCB. Extreme caution should be exercised at all times when working with this instrument.**

Table 4-3. TROUBLESHOOTING

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 1 | Prepare the 5215A for troubleshooting by performing Equipment Preparation in paragraph 4-41. In addition remove the Preamplifier and Power Amplifier shields, then connect the Auxiliary Power line cord only to the line voltage supply. Do not connect the HV Power Line cord to a supply at this time. | | |
| 2 | Verify the Front Panel LOW and Ground terminals are connected with a shorting link and the POWER switch is in the OFF position. | | |
| 3 | Set the POWER switch to the ON position. | | |
| 4 | With the test DVM LO connected to TP22 on the Preamp check for +15 ±0.1V dc adjustable with R82 at tp11 and for −15 ±0.4V dc at tp12. | | |
| 5 | Are both voltages within tolerance? | 7 | 6 |
| 6 | Check the 31V rms input from the Auxiliary Power Supply. Check the rectifier CR70, the applicable filter, series pass transistor, divider and the regulator circuit. Repair as required then repeat the test starting at step 4. | | |
| 7 | With the test DVM LO input at tp9 of the Preamplifier check for +25 ±1V dc at tp10. | | |
| 8 | Is the reading within tolerance? | 10 | 9 |
| 9 | Check the 21V rms input from the auxiliary power supply, the rectifier CR175 and its associated components. Repair as required then repeat the test starting at step 7. | | |
| 10 | With the test DVM LO input at tp7 of the Preamplifier check for −31 ±1V dc at tp17 and +30.5 ±1V dc at tp8. | | |
| 11 | Are both readings within tolerance? | 13 | 12 |
| 12 | Check the 40V rms input from the auxiliary power supply, the rectifier CR182 and its associated components. Repair as required then repeat the test starting at step 10. | | |
| 13 | With the test DVM LO input at tp315 of the Power Amplifier check for +450 ±5V dc at tp325, −25 ±0.5V dc at tp321 and +24 ±0.5V dc at tp 322. | | |
| 14 | Are all three voltages within tolerance? | 16 | 15 |
| 15 | Check the 171V rms and 38V rms inputs from the auxiliary power supply. Check the rectifiers and their associated components. Repair as required then repeat the test starting at step 13. | | |
| 16 | With the test DVM LO input at tp303 of the Power Amplifier check for +440 ±5V dc at tp304 and +14.5 ±0.2V dc at tp 305. | | |

Table 4-3. TROUBLESHOOTING (Cont.)

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 17 | Are both voltages within tolerance? | 19 | 18 |
| 18 | Check the 171V rms and 12V rms inputs from the Auxiliary Power Supply. Check the rectifier circuits and their associated components. Repair as required then repeat the test starting at step 16. | | |
| 19 | With the test DVM LO input at tp407 of the Logic Assembly check for +34 ±1V dc at tp405 and +5 ±0.25V dc at tp409. | | |
| 20 | Are both voltages within tolerance? | 22 | 21 |
| 21 | Check the 21V rms and 8.5V rms inputs from the Auxiliary Power Supply. Check the respective rectifiers CR18 and CR17 and their associated components. Repair as required then repeat the test starting at step 19. | | |
| 22 | Set the POWER switch to OFF. | | |
| 23 | Perform or verify the preparation portion of the calibration procedure contained in paragraphs 4-32 through 4-47. Insure the Preamplifier and Power Amplifier shields are replaced. | | |
| 24 | Connect the HV Power Line cord to the autotransformer and set the autotransformer output voltage to the nominal line voltage. | | |
| 25 | Verify the Power switch is OFF. | | |
| 26 | Set the POWER switch to ON. | | |
| 27 | Did the INSTRUMENT ON indicator illuminate, are all other indicators extinguished and is the fan audible? (A momentary flash of the FAULT indicator is normal.) | 31 | 28 |
| 28 | Is the trouble the absence of a valid response? | 29 | 30 |
| 29 | If the fan is not audible check the input auxiliary power, the POWER switch, the power jumper connections and the fan itself. If none of the indicators illuminate check the outputs of Transformer T3 in the Power Supply. If the incandescent lamp indicator INSTRUMENT ON does not illuminate check the bulbs and the +28V Power Supply on the Logic Assembly. For the LED indicators check the LEDs and the +5V Power Supply. Check the Warm-Up Delay circuit and CR24 if the WARMUP indicator does not illuminate. Repair as required then repeat the test beginning at step 23. | | |
| 30 | Perform the applicable portions of the following step for the presence of an invalid response. If the FAULT indicator illuminates and stays illuminated check the logic inputs to the Fault Gate (U44 Logic Assy), including the signals that effect the gate by clearing the Trouble FF, or for the presence of an Operate Command from the Interface circuits. Use the Logic Trip Adjustment procedure in paragraph 4-129 to set the indication for the +5 volts if applicable. | | |

Table 4-3. TROUBLESHOOTING (Cont.)

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 30 (cont) | If the FAULT indicator illuminates after a delay of approximately 6 seconds check the Fault Gate input from the switch controlled by the Fan air speed. If the OVERLOAD indicator illuminates check the disabling circuit between the Warm-Up Delay circuit and U8-11 on the Logic Assy. Repair as required then repeat the test beginning at step 23. | | |
| 31 | After a delay of approximately 30 seconds does the WARMUP indicator extinguish and the FAULT and OVERLOAD indicator remain extinguished? | 39 | 32 |
| 32 | Does the WARMUP indicator remain illuminated? | 33 | 34 |
| 33 | Check the Warm-Up Delay circuitry. Repair as required then repeat the test beginning at step 23. | | |
| 34 | Is the FAULT indicator illuminated and the OVERLOAD indicator extinguished? | 35 | 36 |
| 35 | Check the inputs to the Fault Gate, especially the ± Supply Current Monitor input to the comparator from the power supply assy. Repair as required then repeat the test beginning at step 23. | | |
| 36 | Is the OVERLOAD indicator illuminated and the FAULT indicator extinguished? | 37 | 38 |
| 37 | Check the Overload Delay circuitry on the Logic Assy and its input from the Overload and Logic circuitry on the Preamplifier assembly. Repair as required then repeat the test beginning at step 23. | | |
| 38 | When both FAULT and OVERLOAD indicators are illuminated check the Overload Delay circuitry on the Logic Assy and its input from the Overload and Logic circuitry on the Preamplifier assembly. Check the inputs to the comparators that control the Fault Gate and Trouble Flip Flop. Repair as required and then repeat the test beginning at step 23. | | |
| 39 | Set the 5200A switch to OPERATE. | | |
| 40 | Does the OPERATE indicator illuminate and the FAULT and OVERLOAD indicators remain extinguished? (Disregard momentary flashes of the FAULT and OVERLOAD indicators during switching.) | 48 | 41 |
| 41 | Does the OPERATE indicator fail to illuminate and the FAULT and OVERLOAD indicators remain extinguished? | 42 | 43 |
| 42 | Check the Operate Command through the Interface circuit and the Operate Flip Flop. Repair as required then repeat the test beginning at step 39. | | |
| 43 | Does the OPERATE indicator illuminate momentarily then extinguish and the FAULT indicators illuminate? | 45 | 44 |

Table 4-3. TROUBLESHOOTING (Cont.)

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 44 | For an OVERLOAD indication without a FAULT indication, check the input to the Overload Delay circuitry from the Preamplifier and the Input and Output stages of the Preamplifier, and the Output stage of the Power Amplifier for loading then repeat the test beginning at step 39. | | |
| 45 | To isolate the problem determine whether the fault is major or minor, as defined in the Theory of Operation, paragraph 3-36 through 3-45. Set the 5200A MODE switch to STDBY. If the FAULT indicator extinguishes the fault is minor and the MODE switch may be set to OPERATE. If the FAULT indicator remains illuminated the fault is major and the POWER switch must be set to OFF to clear the fault. Then resume operations by setting the POWER switch to ON and after the Warmup period the 5200A MODE switch to OPERATE. | | |
| 46 | Does the Fault remain after the circuitry has been reset at least once? | 47 | 48 |
| 47 | For a minor fault determine whether the input at U15-3, U15-4 or U15-5 is clearing the Operate FF, and from there back to the Fault Gate (U44), NEG HV or the Warm-Up Delay circuitry respectively. For an OVERLOAD indication in addition to the FAULT indication check the NEG HV and OVERLOAD inputs to the Fault and Overload Delay Circuitry from the Preamplifier Logic Circuitry. For a major fault determine whether the input at U15-9, U15-10 or U15-11 is clearing the Trouble FF, and from there back to the Operate Circuit, U21 comparator, U22 comparator or SENSE HV circuitry respectively. Repair as required then repeat the test beginning at step 39. | | |
| 48 | Set the 5200A MODE switch to STDBY, the POWER switch to OFF and the Autotransformer output to zero volts.<br><br>WARNING!<br>**Lethal voltages are present during the following tests. Read Test preparation and prepare the equipment as described in paragraphs 4-44 through 4-52 before continuing.** | | |
| 49 | Perform the Upper Tube Balance calibration starting at paragraph 4-53; | | |
| 50 | Are the readings on the oscilloscope and DVM adjustable with stated tolerances? | 52 | 51 |
| 51 | Check the Upper Tube stage and its regulating circuit. Repair as required then repeat the test beginning at step 49. | | |
| 52 | Perform the Lower Tube Balance calibration starting at paragraph 4-55. | | |
| 53 | Are the readings on the oscilloscope and DVM adjustable within the stated tolerances? | 55 | 54 |
| 54 | Check the Lower Tube stage and its regulated circuit. Repair as required then repeat the test beginning at step 52. | | |
| 55 | Perform the Output Stage Bias Current Calibration starting at paragraph 4-58. | | |
| 56 | Are the readings on the oscilloscope and DVM adjustable within the stated tolerance? | 58 | 57 |

Table 4-3. TROUBLESHOOTING (Cont.)

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 57 | Check the output stage class AB Amplifier (Q11 and Q12) and their associated components. Repair as required then repeat the test beginning at step 55. | | |
| 58 | Perform the LED Loop Bias Current Calibration starting at paragraph 4-61. | | |
| 59 | Is the oscilloscope current display adjustable to within the stated tolerance? | 61 | 60 |
| 60 | Check the Power Amplifier 30mA current source stage. Repair as required then repeat the test beginning at step 58. | | |
| 61 | Perform the LED Loop Bandwidth Calibration starting at paragraph 4-64. | | |
| 62 | Is the oscilloscope current display adjustable to within the stated tolerance? | 64 | 63 |
| 63 | Check the Power Amplifier 30 mA current source stage. Repair as required then repeat the test beginning at step 61. | | |
| 64 | Perform the Screen Voltage Calibration starting at paragraph 4-67. | | |
| 65 | Is the Lower Tubes Absolute Screen Voltage adjustable within the stated tolerance? | 67 | 66 |
| 66 | Check the Lower Tubes screen regulator circuitry. Repair as required then repeat the test beginning at step 63. | | |
| 67 | Is the Upper Tube Absolute Screen Voltage adjustable within the stated tolerance? | 69 | 68 |
| 68 | Check the Upper Tubes Screen Regulator Circuitry. Repair as required then repeat the test beginning at step 64. | | |
| 69 | Perform the Positive and Negative Current Trip Level Adjustment in paragraphs 4-70 thru 4-75. | | |
| 70 | Are the Current Trip Circuits adjustable within the stated tolerance? | 72 | 71 |
| 71 | Check the Logic Assembly Fault and Comparator circuits and the input from the Power Supply. Repair as required then repeat the test starting at step 69. | | |
| 72 | Perform the Preamplifier $\pm$ 15 Supply Voltage Calibration. Start with the preparation procedure in paragraph 4-77. | | |
| 73 | Are the $\pm$ 15 Volt supplies adjustable within the stated tolerances? | 75 | 74 |
| 74 | Check the $\pm$ 15 Volt power supply and its 31V rms input from the Auxiliary supply. Repair as required then repeat the test starting at step 72. | | |
| 75 | Perform the Preamplifier Minimum Negative High Voltage Trigger Level Calibration starting at paragraph 4-85. | | |

Table 4-3. TROUBLESHOOTING (Cont.)

| STEP NO. | ACTION | Go to the step number given for correct response | |
|---|---|---|---|
| | | YES | NO |
| 76 | Is the result of the test acceptable? | 78 | 77 |
| 77 | Check the −2.5kV input to the Preamplifier, the Logic Stage of the Preamplifier and the Fault circuits on the Logic Assembly. Repair as required then repeat the test starting at step 75. | | |
| 78 | Perform the Preamplifier Overload Trigger Balance Calibration starting at paragraph 4-88. | | |
| 79 | Is the DC Balance adjustable within the stated tolerance? | 81 | 80 |
| 80 | Check the Power Amp 30 mA current source the Preamplifier output state and the Preamplifier Input stage (input amp in particular). Repair as required then repeat the test starting at step 78. | | |
| 81 | Is the AC Balance adjustable within the stated tolerance? | 83 | 82 |
| 82 | Check the Preamplifier Input and Overload stages, in particular check the Slew Rate Sense Amplifier. Repair as required then repeat the test starting at step 78. | | |
| 83 | Prepare the instrument for further calibration as outlined in the Calibration Point Adjustments (paragraph 4-91 procedures. | | |
| 84 | Perform the DC Offset Calibration starting at paragraphs 4-95. | | |
| 85 | Is the DC Offset adjustable within the stated tolerance? | 87 | 86 |
| 86 | Check the Preamplifier Input stage, the Input amplifier in particular. Repair as required then repeat the test starting at step 84. | | |
| 87 | Perform the Low and High Frequency Gain Adjustment Procedure starting at paragraph 4-98. | | |
| 88 | Is the transfer standard null obtainable to the stated tolerances? | 90 | 89 |
| 89 | Check the Preamplifier feedback circuits. If the 5215A has maximum output regardless of the 5200A setting check the sensing circuits (op amp, divider, cables and associated components). Repair as required then repeat the test starting at step 87. | | |
| 90 | Troubleshooting of the 5215A Power Amplifier is complete. If any component was replaced or an adjustment changed a calibration procedure should be performed. | | |

# Section 5
# Lists of Replaceable Parts

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## 5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the Instrument. Components are listed alpha numerically by assembly. Electrical components are listed by item number. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

a. Reference Designation or Item Number.

b. Description of each part.

c. Fluke Stock Number.

d. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)

e. Manufacturer's Part Number or Type.

f. Total Quantity per assembly of component.

g. Recommended Quantity: This entry indicates the recommending number of spare parts necessary to support one to give instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

h. Use Code is provided to identify certain parts that have been added, deleted or modified during production of the instrument. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity, paragraph 5-7.

## 5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information:

a. Quantity.

b. Fluke Stock Number.

c. Description.

d. Reference Designation or Item Number.

e. Printed Circuit Board Part Number.

f. Instrument Model and Serial Number.

## 5-7. USE CODE EFFECTIVITY LIST

| USE CODE | SERIAL NUMBER EFFECTIVITY |
|---|---|

Table 5-1. FINAL ASSEMBLY

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **FINAL ASSEMBLY (Figure 5-1 thru 5-9)** | | | | | | |
| | **Power Switches View (Figure 5-1)** | | | | | | |
| 101 | Angle, Power Switch | 336701 | 89536 | 336701 | 1 | | |
| 102 | Bracket, Angle | 356030 | 89536 | 356030 | 1 | | |
| 103 | Bracket, Center | 400887 | 89536 | 400887 | 1 | | |
| 104 | Bracket, Power Switch | 336693 | 89536 | 336693 | 1 | | |
| 105 | Coupler, Disc. | 360537 | 89536 | 360537 | 1 | | |
| 106 | Switch, Toggle | 326363 | 27191 | 8822K20 | 2 | | |
| | **Rear Panel View (Figure 5-2)** | | | | | | |
| 201 | Bushing, Strain Relief, Aux line | 436394 | 28520 | SR6P3-4 | 1 | | |
| 202 | Bushing, Strain Relief, HV Line | 102194 | 28520 | SR-8P-2 | 1 | | |
| 203 | Connector, Female, 3 prong | 247015 | 73586 | M-1538GS | 1 | | |
| 204 | Cord Set, Auxiliary | 409920 | 89536 | 409920 | 1 | | |
| 205 | Cord Set, High Voltage | 409912 | 89536 | 409912 | 1 | | |
| 206 | Fuse Holder | 407775 | 75915 | 341-001AL | 2 | | |
| 207 | Fuse, Slo-Blow, 5A (Aux Supply) | 109215 | 71400 | MDA-TYPE | 1 | | |
| 208 | Fuse, Slo-Blow, 15A (HV Supply) | 392936 | 71400 | MDA-TYPE | 1 | | |
| 209 | Handle, Corner | 295691 | 89536 | 295691 | 4 | | |
| 210 | Hole Plug, Snap Button, 3/8" | 441311 | HEYCO | P-375 | 1 | | |
| 211 | Hole Plug, Snap Button, 5/8" | 407502 | HEYCO | P-625 | 1 | | |
| 212 | Panel, Rear | 336446 | 89536 | 336446 | 1 | | |
| 213 | Plate, Rear | 336495 | 89536 | 336495 | 1 | | |
| 214 | Plate, Spacer | 336966 | 89536 | 336966 | 1 | | |
| 215 | Strap, Rubber, Mousetail | 104794 | 98159 | 2829-115-3 | 1 | | |

NOTE: ITEMS ILLUSTRATED BUT NOT CALLED OUT ARE COMMON HARDWARE.

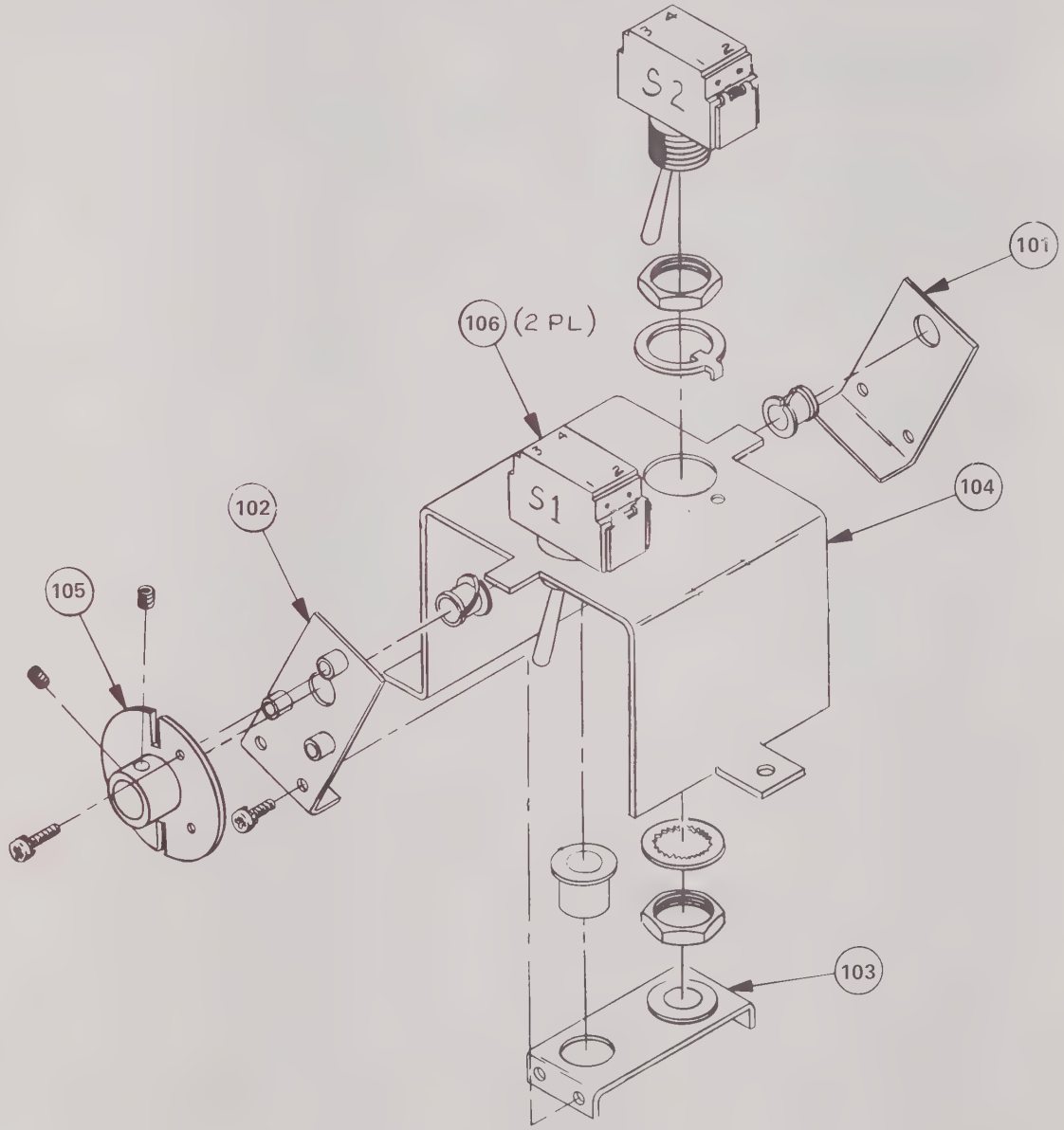



Figure 5–1. POWER SWITCHES VIEW

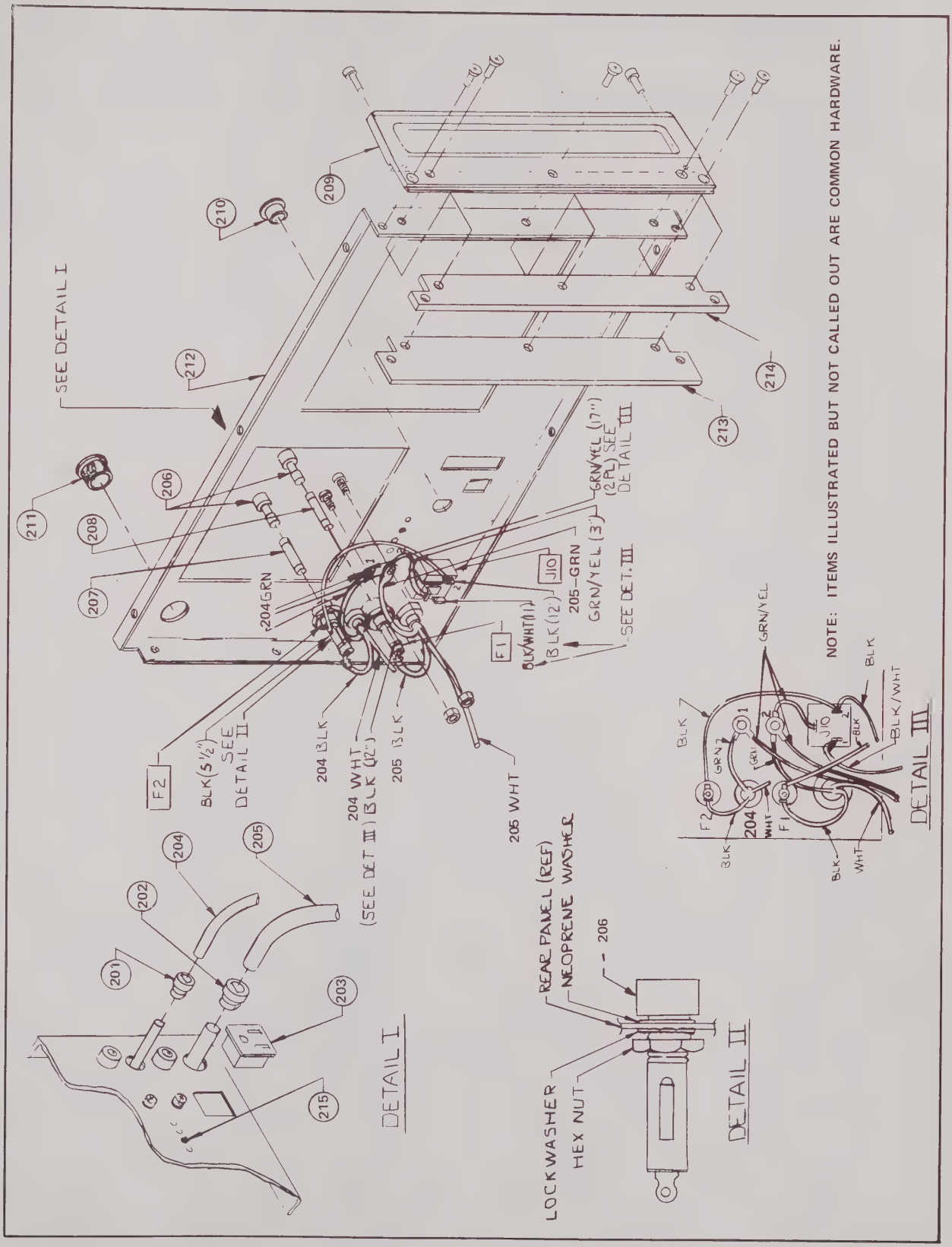



Figure 5-2. REAR PANEL VIEW

Table 5-1. FINAL ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **Front Panel View (Figure 5-3)** | | | | | | |
| 301 | Betel, Window, HV Symbol | 341768 | 89536 | 341768 | 1 | | |
| 302 | Betel, Window, Operate | 367656 | 89536 | 367656 | 1 | | |
| 303 | Bracket, Corner Angle | 298141 | 89536 | 298141 | 2 | | |
| 304 | Binding Post, Black | 275560 | 32767 | 820-45 | 1 | | |
| 305 | Binding Post, White | 275586 | 32767 | 820-25 | 1 | | |
| 307 | Clamp, Cable Storage | 346742 | 89536 | 346742 | 1 | | |
| 309 | Decal, Fluke Logo and Serial Number | 194183 | 89536 | 194183 | 1 | | |
| 310 | Decal Title | 428995 | 89536 | 428995 | 1 | | |
| 311 | Diffuser | 351338 | 89536 | 351338 | 2 | | |
| 312 | Extrusion, Front Panel, Screened | 439216 | 89536 | 439216 | 1 | | |
| 313 | Housing, Cable Plug | 346536 | 89536 | 346536 | 1 | | |
| 314 | Panel Front | 439208 | 89536 | 439208 | 1 | | |
| 315 | Shorting Link | 190728 | 83330 | 21171 | | | |
| 316 | Spacer, Cable Storage | 346726 | 89536 | 346726 | 2 | | |
| | **Tube Chamber View (Figure 5-4)** | | | | | | |
| 401 | Card Guide | 229047 | 23880 | 1800F | 8 | | |
| 402 | Switch, Air | 417602 | 89536 | 417402 | 1 | | |
| 403 | Assy, Tube Chamber | 337402 | 89536 | 337402 | 1 | | |
| | **Left Side View (Figure 5-5)** | | | | | | |
| 501 | Bracket, Angle | 166322 | 73734 | 1552 | 2 | | |
| 502 | Assy, Cable | 349589 | 89536 | 349589 | 1 | | |
| 503 | Relay Armature | 387415 | 78290 | 425BXXW | 1 | | |
| 504 | Sidewall, Left | 336529 | 89536 | 336529 | 1 | | |
| 505 | Switch, Pushbutton | 408500 | 01963 | E69-30A | 1 | | |
| 506 | Tap Board | 336743 | 89536 | 336743 | 1 | | |

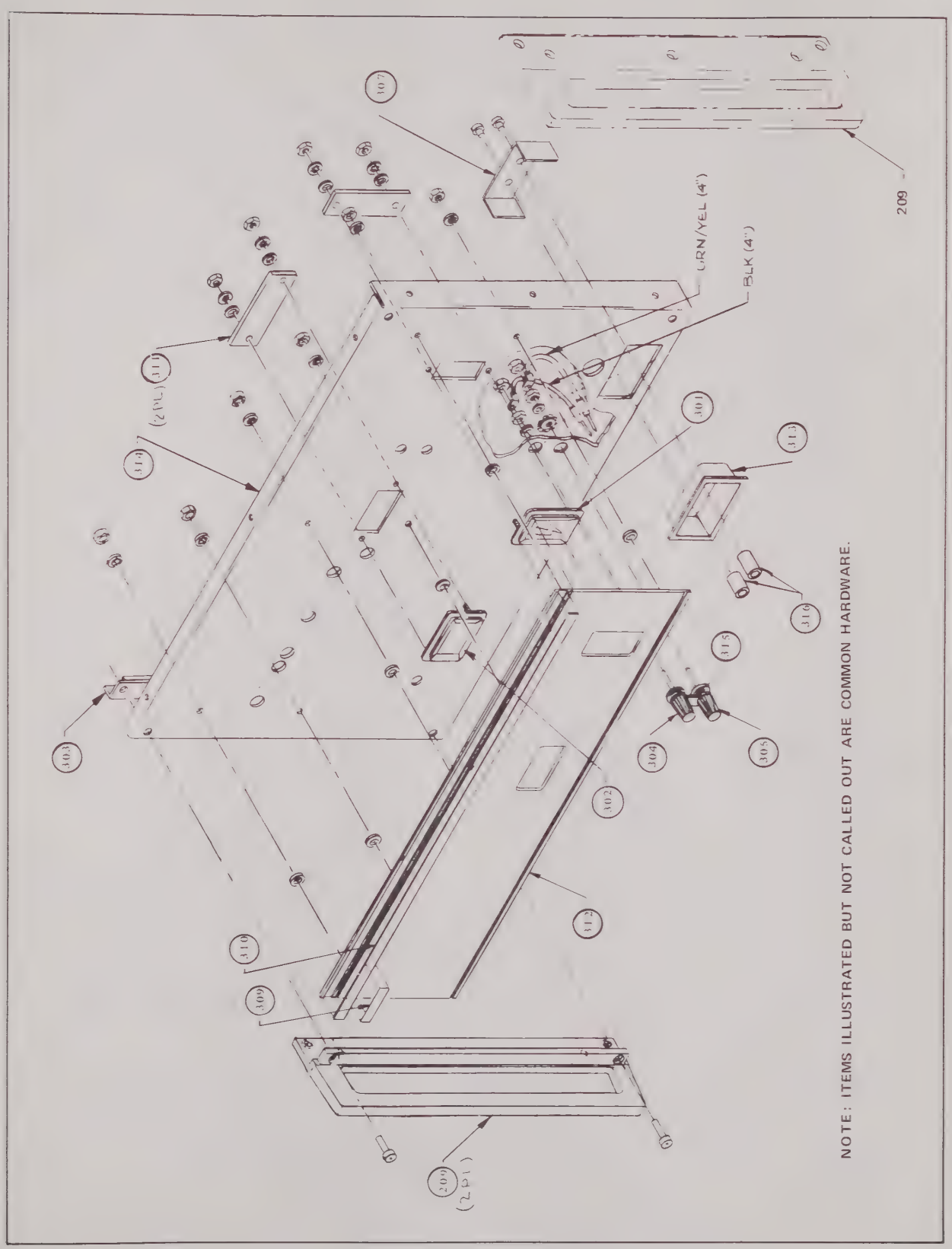



Figure 5-3. FRONT PANEL VIEW

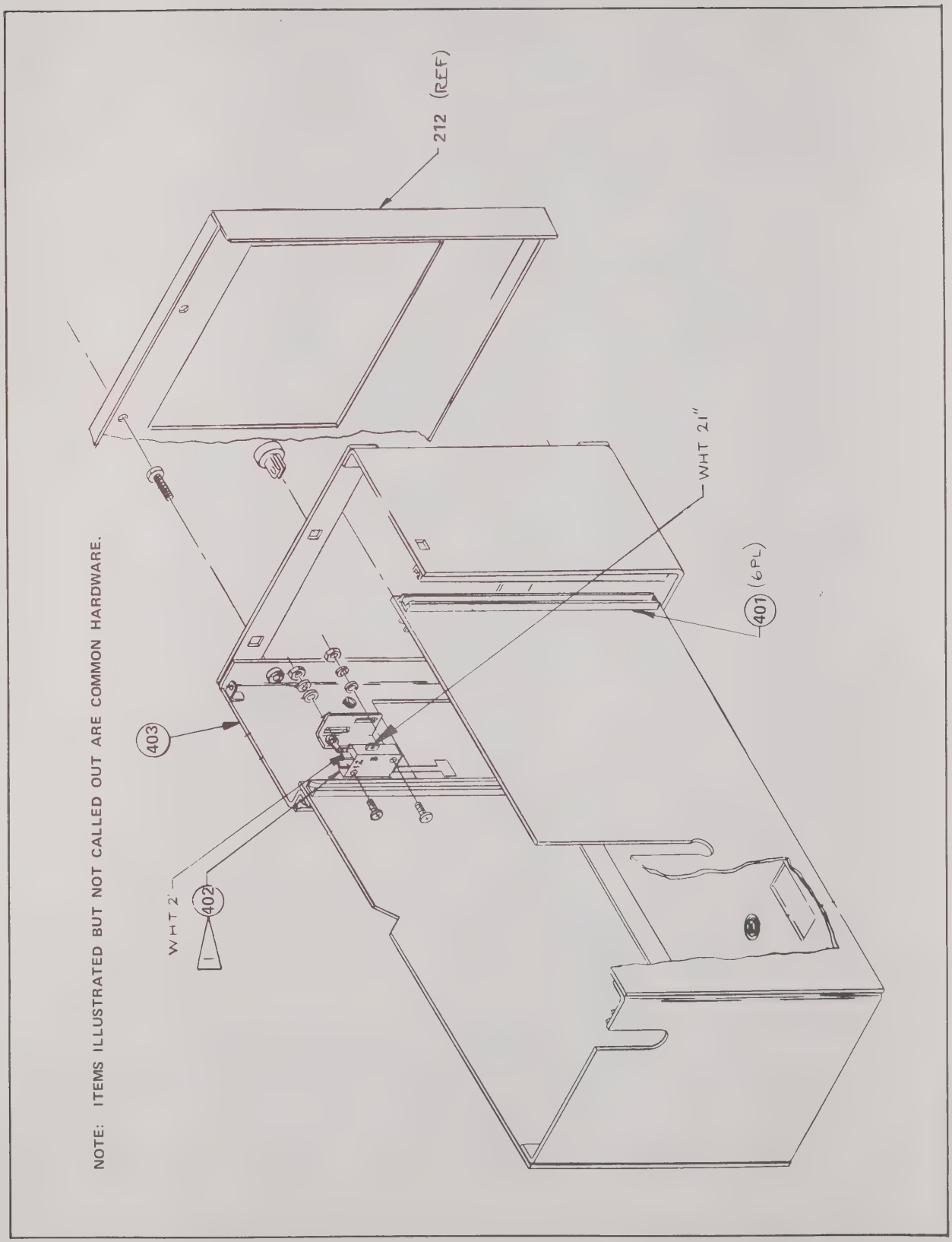



Figure 5-4. TUBE CHAMBER VIEW

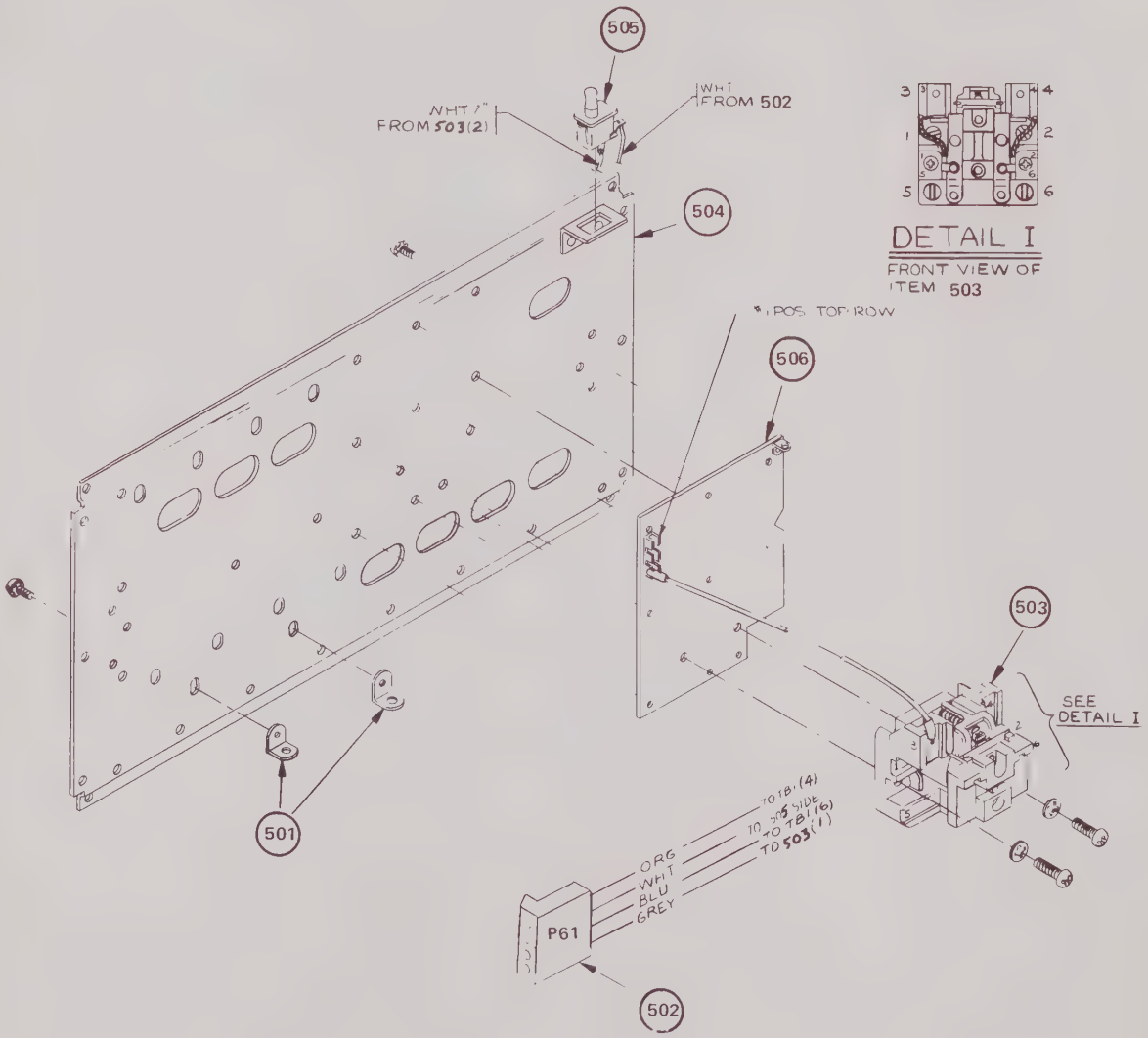



Figure 5-5. LEFT SIDE VIEW.

Table 5-1. FINAL ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **Power Supply View (Figure 5-6)** | | | | | | |
| C11, C12 | Cap, Oil filled 4 uF ±15%, 400V | 387431 | 00646 | CKM2-40-4M53 | 2 | | |
| C13 | Cap, Oil filled, 1 uF ±10%, 400V | 387423 | 00686 | CKM2-40-1M | 1 | | |
| T3 | Transformer, Preamp | 336917 | 89536 | 336917 | 1 | | |
| T4 | Transformer, Power Amp | 397844 | 89536 | 397844 | 1 | | |
| 601 | Assy, PCB, Mother | 336818 | 89536 | 336818 | 1 | | |
| 602 | Assy, Bleeder Power Amp | 401000 | 89536 | 401000 | 2 | | |
| R1 thru R5 | Res, comp, 1M ±10%, 2W | 136671 | 01121 | HB3341 | 5 | | |
| 603 | Assy, Bleeder, Preamp | 400994 | 89536 | 400994 | 1 | | |
| R1 thru R5 | Res, comp, 330k ±10%, 2W | 208227 | 01121 | HB1051 | 5 | | |
| 604 | Bracket, fan | 336552 | 89536 | 336552 | 1 | | |
| 605 | Bracket, Transformer | 336453 | 89536 | 336453 | 1 | | |
| 606 | Cable Assy, Preamp HV | 349517 | 89536 | 349517 | 1 | | |
| 607 | Cable Assy, Neg HV | 346601 | 89536 | 346601 | 1 | | |
| 608 | Cable Assy, Pos HB | 346569 | 89536 | 346569 | 1 | | |
| 609 | Clamp, HV | 419473 | 89536 | 419473 | 1 | | |
| 610 | Instrument Bottom | 336479 | 89536 | 336479 | 1 | | |
| 611 | Shaft, Power Switch | 400960 | 89536 | 300960 | 1 | | |
| | **Low Capacity View (Figure 5-7)** | | | | | | |
| T2 | Transformer, Lo Cap | 336909 | 89536 | 336909 | 1 | | |
| 701 | Bulkhead, Central | 336461 | 89536 | 336461 | 1 | | |
| 702 | Clamp, Lo Cap Xfmr | 400895 | 89536 | 400895 | 1 | | |
| 703 | Screen | 401034 | 89536 | 401034 | 1 | | |

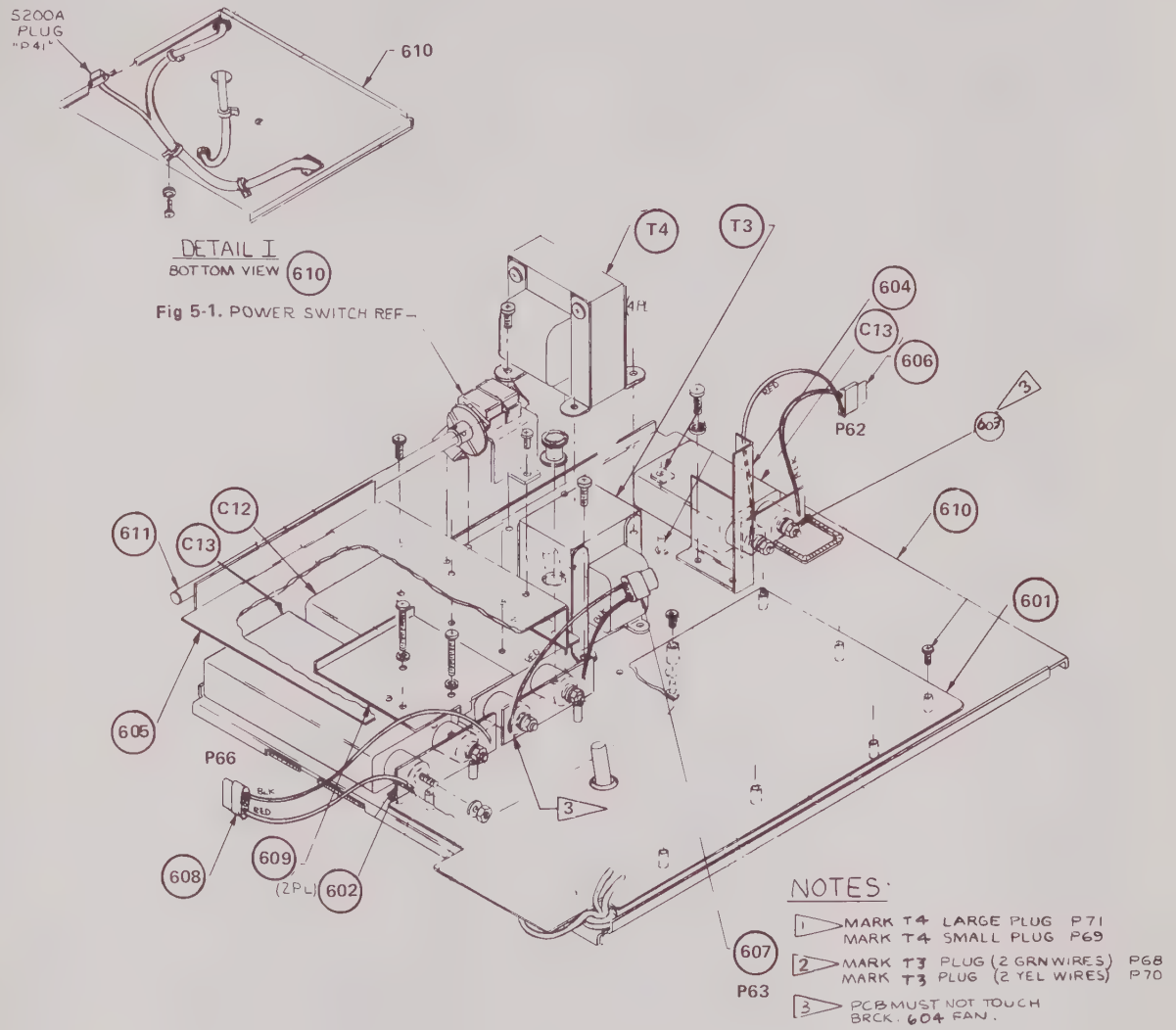
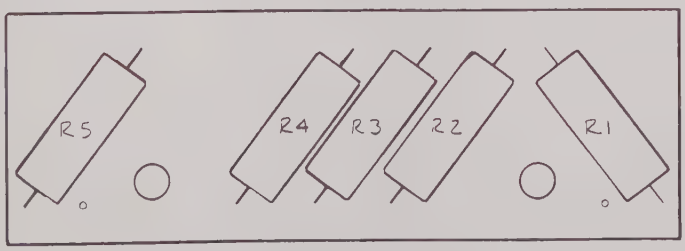
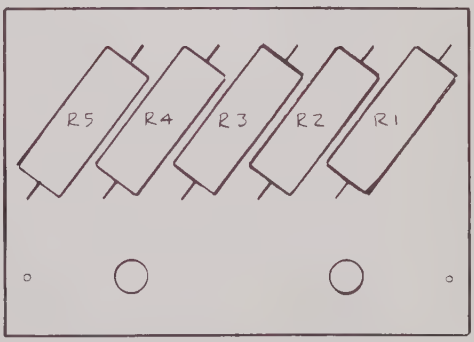



Fig 5-1. POWER SWITCH REF—

NOTE: ITEMS ILLUSTRATED BUT NOT CALLED OUT ARE COMMON HARDWARE.




POWER AMP BLEEDER PCB ASSY




PREAMP BLEEDER PCB ASSY

Figure 5-6. POWER SUPPLY VIEW

NOTE: ITEMS ILLUSTRATED BUT NOT CALLED OUT ARE COMMON HARDWARE.

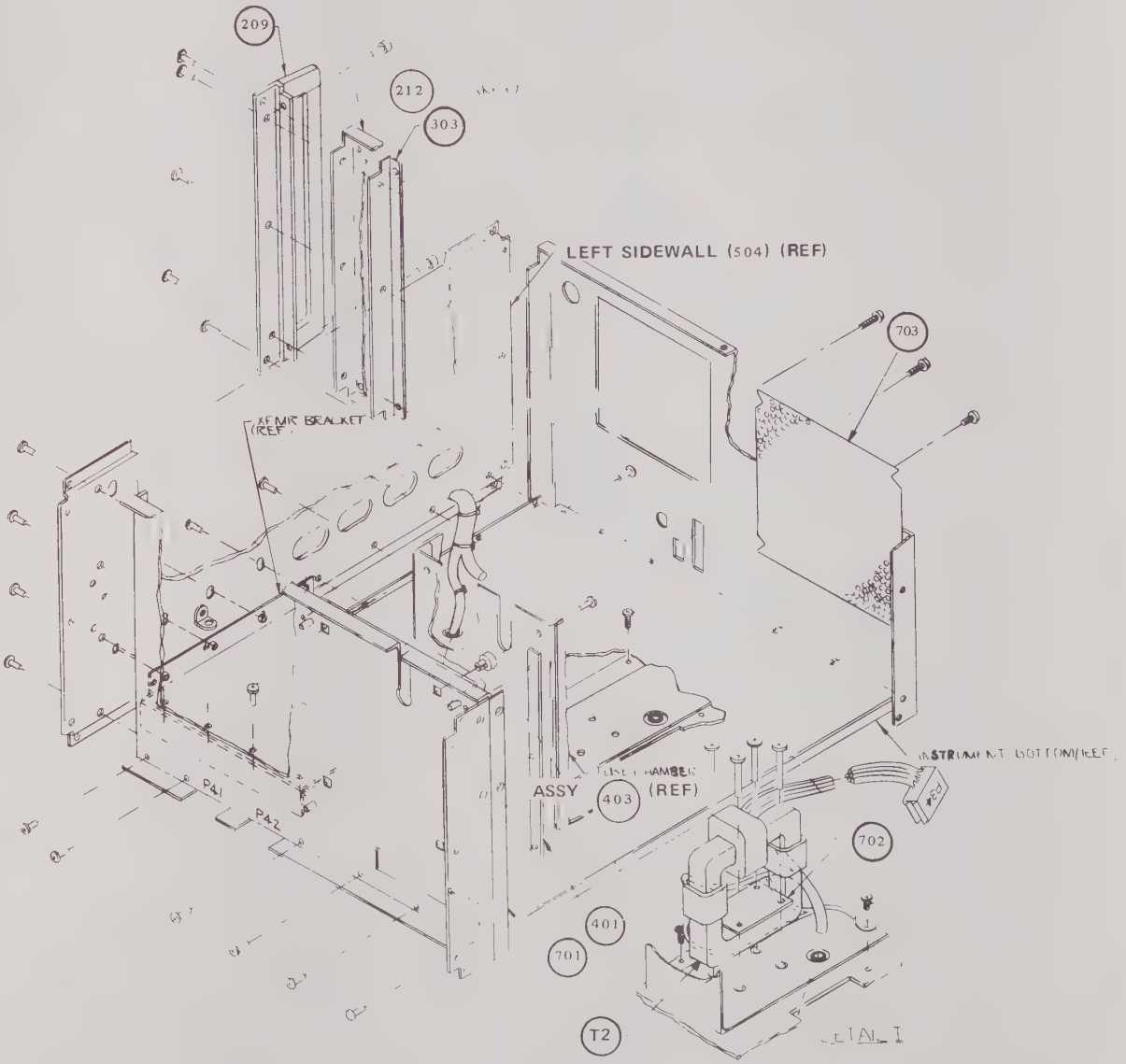
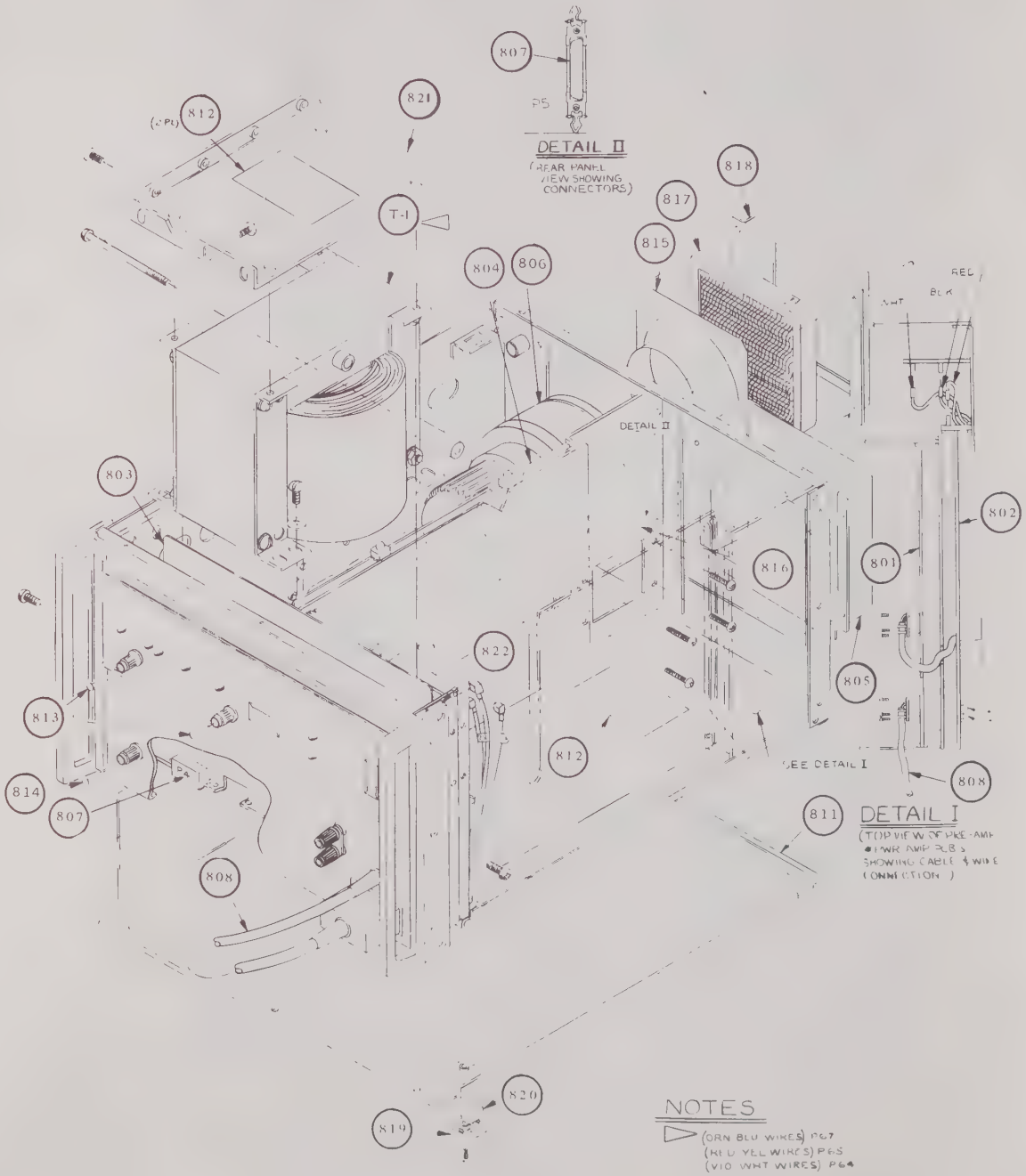



Figure 5-7. LOW CAPACITY VIEW

Table 5-1. FINAL ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **Interior View (Figure 5-8)** | | | | | | |
| T1 | Transformer, HV | 336891 | 89536 | 336891 | 1 | | |
| 801 | Assy, Power Amp. | 341511 | 89536 | 341511 | 1 | | |
| 802 | Assy, Preamp | 439299 | 89536 | 439299 | 1 | | |
| 803 | Assy, Logic PCB | 439307 | 89536 | 439307 | 1 | | |
| 804 | Assy, Power Supply PCB | 362111 | 89536 | 362111 | 1 | | |
| 805 | Airduct | 400861 | 89536 | 400861 | 1 | | |
| 806 | Blower | 330068 | 82877 | VS37A2-12 | 1 | | |
| 807 | Cable Assy, Control, (P5 to P41, J25 & J26) | 346544 | 89536 | 346544 | 1 | | |
| 808 | Cable Assy, Output | 341552 | 89536 | 341552 | 1 | | |
| 810 | Clamp, Cable, Nylon (Not illustrated rear of Front Panel) | 102265 | 06383 | SST-2 | 1 | | |
| 811 | Cover, Bottom | 336677 | 89536 | 336677 | 1 | | |
| 812 | Decal, Danger | 336859 | 89536 | 336859 | 2 | | |
| 814 | Decal, Knob, Green | 341339 | 89536 | 341339 | 1 | | |
| 815 | Fan Intake, Bellmouthed | 336503 | 89536 | 336503 | 1 | | |
| 816 | Fan Nut Plate | 336545 | 89536 | 336545 | 1 | | |
| 817 | Filter Intake | 402834 | 89536 | 402834 | 1 | | |
| 818 | Frame, Filter | 400945 | 89536 | 400945 | 1 | | |
| 819 | Foot, Bail Stand | 292870 | 89536 | 292870 | 6 | | |
| 820 | Foot Insert, Nonskid | 420422 | 89536 | 420422 | 6 | | |
| 821 | Plate, Power Transformer | 400309 | 89536 | 400309 | 1 | | |
| 822 | Plate, Spacer | 336966 | 89536 | 336966 | 1 | | |
| 823 | Spring Clip | 330134 | 02660 | 17-529 | 1 | | |
| 824 | Spacer | 403071 | 89536 | 403071 | 1 | | |
| 825 | Plate, Connector Cover | 439604 | 89536 | 439604 | 1 | | |




NOTE: ITEMS ILLUSTRATED BUT NOT CALLED OUT ARE COMMON HARDWARE.

Figure 5-8. INTERIOR VIEW

Table 5-1. FINAL ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **Exterior View (Figure 5-9)** | | | | | | |
| 901 | Cover, Low Capacity Chamber | 336636 | 89536 | 336636 | 1 | | |
| 902 | Cover, Right Side | 337410 | 89536 | 337410 | 1 | | |
| 903 | Cover, Top | 336669 | 89536 | 336669 | 1 | | |
| 904 | Cover, Transformer | 336644 | 89536 | 336644 | 1 | | |
| 905 | Cover, Tube Chamber | 336594 | 89536 | 336594 | 1 | | |
| 906 | Decal, Corner | 296293 | 89536 | 296293 | 4 | | |
| 907 | Decal, Handle Trim | 295527 | 89536 | 295527 | 4 | | |
| 908 | Decal, Side Trim | 295402 | 89536 | 295402 | 2 | | |
| 909 | Decal, Danger | 336719 | 89536 | 336719 | 2 | | |
| 910 | Decal, HV | 349464 | 89536 | 349464 | 1 | | |
| 911 | Decal, Ground | 349456 | 89536 | 349456 | 1 | | |
| 912 | Shield, Pre Amp | 353425 | 89536 | 353425 | 1 | | |
| 913 | Sidewall, Right | 336537 | 89536 | 336537 | 1 | | |
| 914 | Plug, Hole | 441253 | 89536 | 441253 | 5 | | |
| 915 | Kit Accessory (Not illustrated) | 440149 | 89536 | 440149 | 1 | | |
| | Cable Assy. Interconnect (5205A to 5200A) | 341560 | 89536 | 341560 | 1 | | |
| | PCB, Shorting | 400762 | 89536 | 400762 | 3 | | |

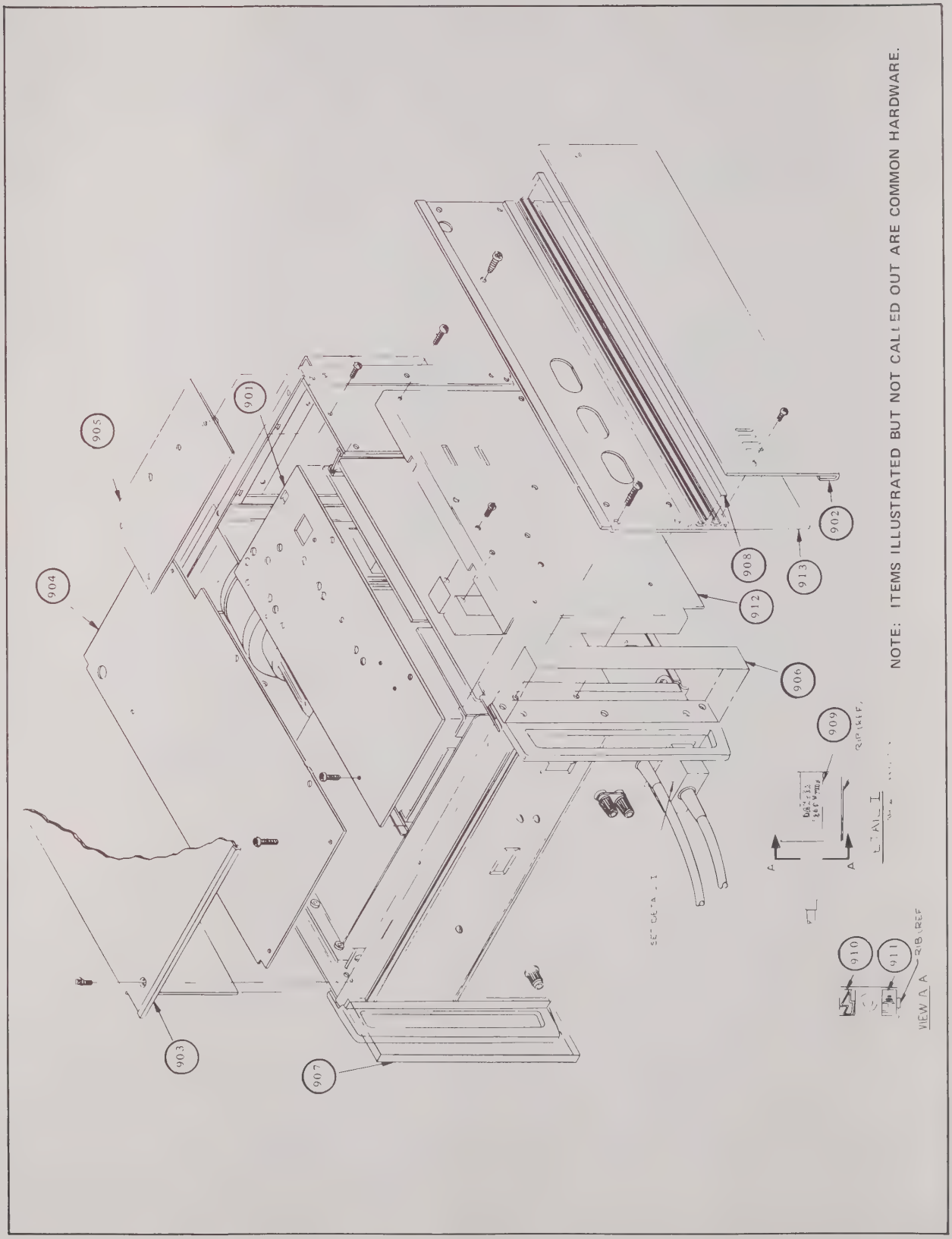



Figure 5-9. EXTERIOR VIEW

Table 5-2. PCB ASSEMBLY, MOTHERBOARD

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | PCB ASSY. MOTHERBOARD (Figure 5-10) | 336818 | 89536 | 336818 | REF | | |
| E1 | Protector, Spark Gap | 198507 | 25088 | B1F90 | 1 | | |
| J20, J21 | Connector, 9 position/2 removed | 352682 | 00779 | 583694-2 | 2 | | |
| J22 | Connector, 3 position | 291625 | 00779 | 583650-1 | 1 | | |
| J23 | Connector, 6 position | 291898 | 00779 | 583650-2 | 1 | | |
| J30 | Connector 5 position/1 removed | 404020 | 00779 | 583694-7 | 1 | | |
| J31 | Connector 20 position/6 removed | 403980 | 00779 | 583694-3 | 1 | | |
| J43 | Connector 15 position | 291948 | 00779 | 583650-7 | 1 | | |
| J44, J45 | Connector 5 position | 403964 | 00779 | 583407-6 | 2 | | |
| J50 | Connector 11 position/2 removed | 404012 | 00779 | 583694-6 | 1 | | |
| J51 | Connector 9 position/4 removed | 403998 | 00779 | 583694-4 | 1 | | |
| J52 | Connector 11 position/2 removed | 404004 | 00779 | 583694-5 | 1 | | |
| J53 | Connector 7 position | 403972 | 00779 | 583407-8 | 1 | | |
| J54, J56 | Connector 4 position/ | 354951 | 00779 | 583407-5 | 2 | | |
| OL | Connector, Black | 149112 | 74970 | 105-0753 | 1 | | |
| Chas GND | Connector, Green | 149120 | 74970 | 105-0754 | 1 | | |
| VR1, VR2 | Diode Zener | 113365 | 31483 | 69-4978 | 2 | | |

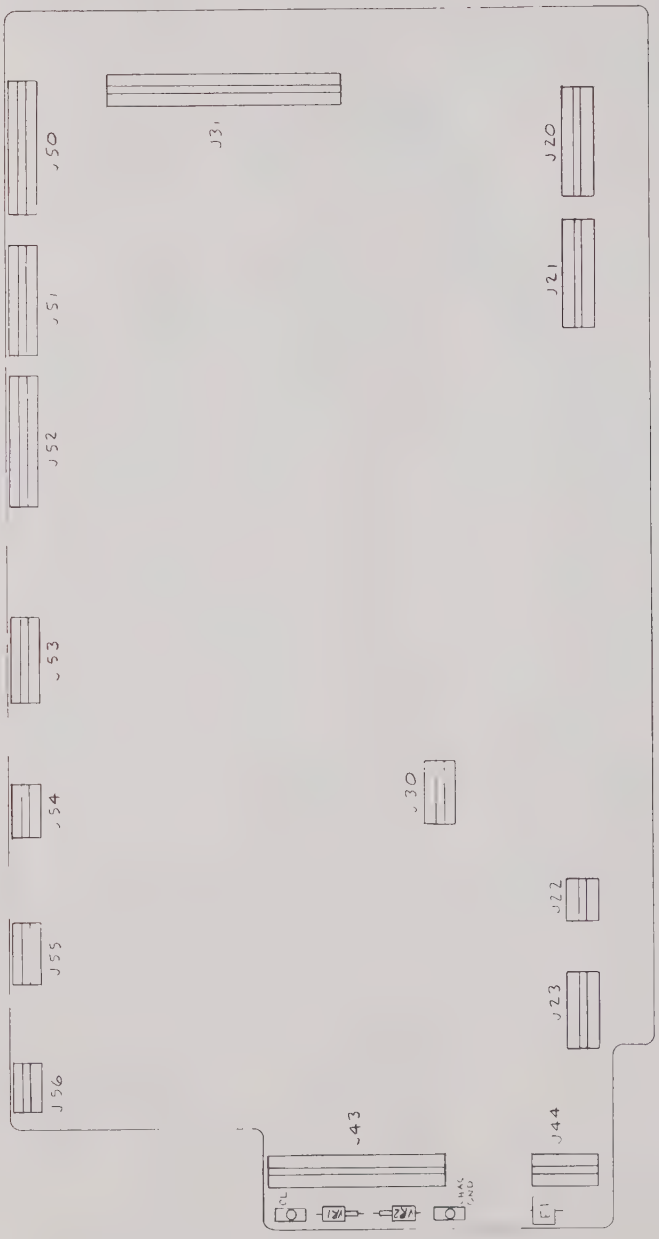



Figure 5-10. PCB ASSY. MOTHERBOARD

Table 5-3. PCB ASSY, POWER SUPPLY

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, POWER SUPPLY (Figure 8-2)** | 362111 | 89536 | 362111 | REF | | |
| C1 | Capacitor, elect, 10 μf ± , 300V | 340885 | 56289 | 500D106F-300DC7 | 1 | | |
| CR1 thru CR4, CR7, CR17, CR18, CR25, CR26 | Diode | 368738 | 04713 | 1N4004 | 9 | | |
| CR6, CR8 | Diode | 203323 | 07919 | 1N448 | 2 | | |
| CR11 thru CR16, CR21 thru CR24 | Diode | 268433 | 04713 | MR250-5 | 10 | | |
| J61, J64 | Connector, 4 pin | 385443 | 27264 | 09-65=1041 | 2 | | |
| J62, J63, J65, J66, J67, J69 | Connector, 2 pin | 413914 | 27264 | 09-65-1041 | 6 | | |
| J68, J70, J71 | Connector, 15 pin | 310094 | 27254 | 03-09-2151 | 3 | | |
| Q1, Q3 | Transistor | 218511 | 95303 | 65120 | 2 | | |
| Q2 | Transistor | 284448 | 89536 | 284448 | 1 | | |
| R1, R20 | Res, comp, 220 ±5%, ¼W | 147959 | 01121 | CB2215 | 2 | | |
| R2 | Res, comp, 220k ±5%, ½W | 108217 | 01121 | CB2245 | 1 | | |

Table 5-3 PCB ASSY. POWER SUPPLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R3 | Res, com, 8.2k ±5%, ¼W | 160796 | 01121 | CB8225 | 1 | | |
| R4 | Res, comp, 3.3k ±5%, ¼W | 148056 | 01121 | CB3325 | 1 | | |
| R5 | Res, comp, 470k ±5%, ½W | 108969 | 01121 | EB4745 | 1 | | |
| U1 | Opto-Isolator | 380014 | 29013 | MCT-2 | 1 | | |
| VR5 | Diode, zener, 110V | 392878 | 07910 | 1N986B | 1 | | |
| | Connector Pin | 342998 | 27269 | 02-09-1118 | 31 | | |
| | Guide, retainer | 341115 | 89536 | 341115 | 3 | | |
| | Heat Sink (Q3) | 104562 | 05820 | NF-209 | 1 | | |
| | Transipad (Q1, Q2, Q3) | 152207 | 07047 | 10123DAP | 3 | | |

## Table 5-4. PCB ASSEMBLY, LOGIC

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, LOGIC (Figure 8-4)** | 346338 | 89536 | 346338 | REF | | |
| | Assy, LED Standoff | 341594 | 89536 | 341594 | 7 | | |
| | Assy, High Voltage Lamps | 400986 | 89536 | 100986 | 1 | | |
| | Bracket, HV Lamps | 400747 | 89536 | 400747 | 1 | | |
| | Plug, Banana | 352716 | 83330 | 431 | 2 | | |
| | Socket, Bayonet Base | 103523 | 95213 | 7-08 | 2 | | |
| | Assy, Operate Lamps | 400978 | 89536 | 400978 | 1 | | |
| | Mounting, Operate Lamps | 400739 | 89536 | 400739 | 1 | | |
| | Plug, Banana | 352716 | 83330 | 431 | 3 | | |
| | Socket, Lamp | 184002 | 95263 | 7-12 | 2 | | |
| C1,C3, C10, C12, C46, C49, C55, C56, C99 | Cap, fxd, cer, 0.05 µf ±20%, 100V | 149161 | 56289 | 55C23A1 | 9 | | |
| C2 | Cap, fxd, Ta, 15 µf ±20%, 6V | 161935 | 56289 | 196D156X-0006 | 1 | | |
| C4,C15, C21, C90, C94 | Cap, fxd, Ta, 6.8 µf ±10%, 35V | 182782 | 56289 | 150D685X903-582 | 5 | | |
| C5,C30 thru C33 | Cap, fxd, cer, 0.1 µf ±20%, 100V | 149146 | 56289 | 33C416B | 5 | | |
| C14, C22, C23, C44 | Cap, fxd, Ta, 1 µf ±20%, 35V | 161919 | 56289 | 196D001X-03582 | 4 | | |
| C20 | Cap, elect, 47 µf −10/+50%, 25V | 168823 | 25403 | ET470X0025 A4 | 1 | 1 | |
| C25, C26, C27 | Cap, elect, 1000 µf −10/±50%, 16V | 193896 | 25403 | ET102X016 A02 | 3 | 1 | |

Table 5-4. PCB ASSEMBLY, LOGIC, (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| C28 | Cap, elect, 470 μF–10/+50%, 40V | 185868 | 25403 | ET471X040-A02 | 1 | 1 | |
| C40 | Cap, fxd, Ta 2.2 μF±20%, 15V | 364216 | 56289 | 196D225X015-HA1 | 1 | | |
| C41 | Cap, fxd, Ta, 0.33 μF±20%, 35V | 408690 | 56289 | 196D334X035-HA | 1 | | |
| C42, C45 | Cap, fxd, Ta, 0.47 μF ±20%, 35V | 161349 | 56289 | 196D474X035-HA1 | 2 | | |
| C43 | Cap, fxd, Ta, 4.7 μF ±20%, 25V | 161943 | 56289 | 196D475X025-KA1 | 1 | | |
| C47, C50 | Cap, fxd, TA, 10 μF ±20%, 10V | 176214 | 56289 | 196D106X010-KA1 | 2 | | |
| C48, C52 | Cap, fxd, cer, 0.01 μF –20/+80%, 100V | 105668 | 00656 | C023B501J103M | 2 | | |
| C53 | Cap, fxd, plastc, 5 μF ±5%, 150V | 364190 | 20908 | Type X564 | 1 | | |
| C54 | Cap, Ta, elect, 220 μF ±10%, 10V | 182840 | 56289 | 150D227X901-0S2 | 1 | 1 | |
| C98, C102 | Cap, Ta, elect, 68 μF ±10%, 15V | 182824 | 56289 | 150D686X901-5R2 | 2 | 1 | |
| CR10 thru CR13, CR16, CR30, CR40, CR42, CR43, CR74, CR97, CR101 | Diode, Si, Hi-Speed switching | 203323 | 07910 | 1N448 | 12 | 3 | |
| CR17, CR18 | Rectifier, bridge | 296509 | 09423 | FB200 | 2 | 1 | |
| CR24, CR26 CR27 | Diode, light emitting | 309617 | 07263 | FLV102 | 3 | 1 | |
| CR41 | Diode, Si | 348177 | 07263 | FD7223 | 1 | 1 | |

Table 5-4. PCB ASSEMBLY, LOGIC (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| D1 thru DS4 | Lamp, Incandescent | 186346 | 71744 | CM1819 | 4 | | |
| K1 | Relay, dry reed | 357566 | 71707 | UF40069 | 1 | | |
| L1,L2 | Choke, H turn | 379222 | 89536 | 379222 | 2 | | |
| Q1,Q2 | Xstr, Si, NPN, power | 343970 | 04713 | MPS-U06 | 2 | 1 | |
| Q3,Q10 | Xstr, Si, NPN | 218396 | 04713 | 2N3904 | 2 | 1 | |
| Q4 | Sxtr, Si, PNP | 288761 | 01295 | SK6808 | 1 | 1 | |
| Q5 | Xstr, Si, NPN | 203489 | 03508 | 11C-2322 | 1 | 1 | |
| R1,R2, R4,R13 | Res, fxd, comp, 2k ±5%, ¼W | 202879 | 01121 | CB2025 | 4 | | |
| R3,R21, R25, R27, R28, R38, R39, R40, R65, R83 | Res, fxd, comp, 4.7k ±5%, ¼W | 148072 | 01121 | CB4725 | 10 | | |
| R5, R120, R122 thru R125 | Res, fxd, comp, 33 +5%, ¼W | 175034 | 01121 | CB3305 | 6 | | |
| R6, R26, R35, R36, R100, R101, R105, R106, R127 | Res, fxd, comp, 220 ±5%, ¼W | 147959 | 01121 | CB2215 | 9 | | |

Table 5-4. PCB ASSEMBLY, LOGIC (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R73, R85, R86, R102, R103, R104, R114, R115, R128, R131 | Res, fxd, comp, 10k ±5%, ¼W | 148106 | 01121 | CB1035 | 10 | | |
| R45, R46 | Res, fxd, comp, 270 ±5%, ½W | 159616 | 01121 | EB2715 | 2 | | |
| R47 | Res, var, cermet, 20k ±10%, ½W | 355529 | 11236 | 362S203AZ | 1 | | |
| R48, R49 | Res, var, cermet, 100k ±10%, ½W | 355537 | 11236 | 362S104AZ | 2 | | |
| R50 | Res, fxd met film, 30.1k ±1%, 1/8W | 168286 | 91637 | MFF1-83012F | 1 | | |
| R51 | Res, fxd, met film, 365k ±1%, 1/8W | 289520 | 91637 | MFF1-83653F | 1 | | |
| R52 | Res, fxd, met film, 383k ±1%, 1/8W | 288498 | 91637 | MFF1-83833F | 1 | | |
| R53, R55, R74, R98 | Res, fxd, comp, 100 ±5%, ¼W | 147926 | 01121 | CB1015 | 4 | | |
| R54 | Res, fxd, comp, 3.3k ±5%, ½W | 165761 | 01121 | CB3325 | 1 | | |
| R60 | Res, fxd, comp, 2.2k ±5%, ¼W | 148049 | 01121 | CB2225 | 1 | | |
| R61 | Res, fxd, comp, 5.6k ±5%, ¼W | 148080 | 01121 | CB5625 | 1 | | |
| R62, R63, R95 | Res, fxd, comp, 22k ±5%, ¼W | 148130 | 01121 | CB2235 | 3 | | |
| R66 | Res, fxd, met film, 187k ±1%, 1/8W | 289462 | 91637 | MFF1-81873F | 1 | | |
| R67 | Res, fxd, met film, 48.7k ±1%, 1/8W | 267385 | 91637 | MFF1-81502F | 7 | | |
| R70, R71, R76, R88, R89, R90, R94 | Res, fxd, met flm, 15k ±1%, 1/8W | 285296 | 91637 | MFF1-81502F | 7 | | |

Table 5-4. PCB ASSEMBLY, LOGIC (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R72, R80, R202 | Res, fxd, comp, 1k ±5%, ¼W | 148023 | 01121 | CB1025 | 3 | | |
| R77 | Res, fxd, mat film, 909 ±1%, 1/8W | 312629 | 91637 | MFF1-89090F | 1 | | |
| R81,R R82, R121 | Res, fxd, comp, 390 ±5%, ¼W | 147975 | 01121 | CB3915 | 3 | | |
| R87 | Res, fxd, comp, 10 ±5%, ¼W | 147868 | 01121 | CB1005 | 1 | | |
| R91 | Res, fxd, met film, 22.1k ±1%, 1/8W | 235234 | 91637 | MFF1-82212F | 1 | | |
| R92 | Res, fxd, met film, 421k ±1%, 1/8W | 276626 | 91637 | MFF1–84223F | 1 | | |
| R93 | Res, fxd, met film, 316k ±1%, 1/8 | 289496 | 91637 | MFF1-83163F | 1 | | |
| R96 | Res, fxd, comp, 33k ±5%, 1/8W | 148155 | 01121 | CB3335 | 1 | | |
| R97 | Res, fxd, comp, 100k ±5%, ¼W | 148189 | 01121 | CB1045 | 1 | | |
| R126, R130 | Res, fxd, comp, 56k ±5%, ¼W | 170738 | 01121 | CB5635 | 2 | | |
| R129 | Res, fxd, comp, 6.8M ±5%, ¼W | 394064 | 01121 | CB6865 | 1 | | |
| R201 | Res, fxd, comp, 30k ±5%, ¼W | 193417 | 01121 | CB3035 | 1 | | |
| U1 | IC, TTL, Dig. Dual NAND | 352690 | 01295 | SN7413N | 1 | 1 | |
| U2 | IC, TTL, Hex, Inverter | 379305 | 01295 | SN7405N | 1 | 1 | |
| U3 | IC, TTL, Dig. Quad 2-input positive NAND Gates | 292961 | 01295 | SN7403N | 1 | 1 | |
| U4 | IC, TTL, Hex Inverter | 292979 | 01295 | SN7404N | 1 | 1 | |
| U5,U20 | IC, TTL, Hex Inverter, Buffer &Driver | 288605 | 01295 | SN7416N | 2 | 1 | |
| U8 | IC, TTL, Quad, 2-Input, Positive NAND | 310201 | 01295 | SN7438N | 1 | 1 | |
| U14 | IC, TTL, Quad, 2-Input Pos OR Gate | 342709 | 01295 | SN7432N | 1 | 1 | |
| U15 | IC, TTL, Triple-3-Input Positive NAND | 363465 | 01295 | SN7412N | 1 | 1 | |
| U21, U22 | IC, Linear, Quad comparator | 387233 | 12040 | LM339N | 2 | 1 | |
| U25 | IC, Linear, Voltage Regulator | 327981 | 12040 | LM309K | 1 | 1 | |

Table 5-4. PCB ASSEMBLY, LOGIC (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| U30, U31 | Opto Isolator | 387076 | 50579 | ILD-74 | 2 | 1 | |
| U40 | IC, TTL, SSI, Hex/Quad | 354886 | 01295 | SN7414N | 1 | 1 | |
| U41 | IC, TLT, Dual J-K Triggered, Flip-Flops | 293100 | 01295 | SN74H106N | 1 | 1 | |
| U42 | IC, Linear, Dual Timer | 387407 | 18324 | NESS6A | 1 | 1 | |
| U43 | IC, TTL, Quad, 2-Input | 292953 | 01295 | SN7400N | 1 | 1 | |
| U44 | IC, TTL Positive NAND Gates, 8-Input | 293019 | 01295 | SN7430N | 1 | 1 | |
| VR3, VR6 | Diode, zener | 180455 | 07910 | 1N749A | 2 | 1 | |
| VR14 | Diode, zener | 172148 | 12065 | 1N3496 | 1 | 1 | |
| XU14, XU15, UX22, XU42 | Socket, IC | 291542 | 00779 | 583527-1 | 5 | | |
| | Bracket, lamp | 400754 | 89536 | 400754 | 2 | | |
| | Heatsink | 342675 | 13103 | 600382 | 1 | | |
| | Jack, banana, nylon | 162065 | 74970 | 108-902 | 5 | | |
| | Transipad, Xstr | 152207 | 07047 | 10123DAP | 1 | | |

## Table 5-5. PREAMPLIFIER ASSEMBLY

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **Assembly, Preamplifier (Figure 5-11)** | 439281 | 89536 | 439281 | 1 | | |
| 1 | PCB Assy; Pre Amp (Refer to Table 5-6) | 439240 | 89536 | 439240 | 1 | | |
| 2 | PCB Assy; Pre Amp Tube Anode (Refer to Table 5-7) | 397281 | 89536 | 397281 | 1 | | |
| 3 | Cable Assy, Sense | 349555 | 89536 | 349555 | 1 | | |
| 4 | Fence, Pre Amp | 337444 | 89536 | 337444 | 1 | | |
| 5 | Fence, Pre Amp | 439570 | 89536 | 439570 | 1 | | |

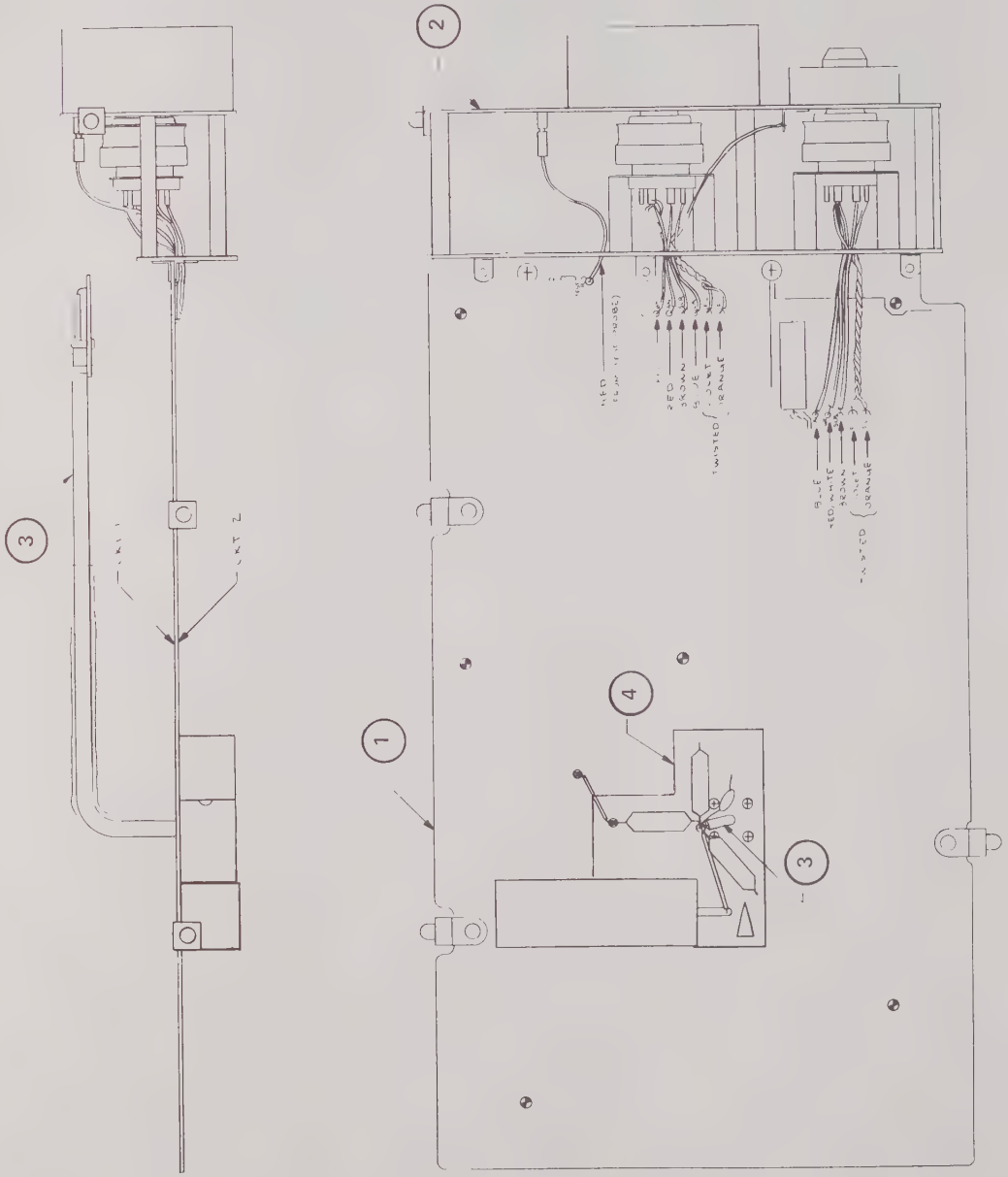



Figure 5-11. PREAMPLIFIER ASSEMBLY LOCATIONS

Table 5-6. PRE AMP PCB ASSEMBLY

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSEMBLY, PRE AMP (Figure 8-6a)** | 353656 | 89536 | 353656 | REF | | |
| | **PCB Assembly, Zener String** (See end of table) | 362129 | 89536 | 362129 | 1 | | |
| C1 | Cap, fxd, Ta, 22 uF ±20%, 35V | 394775 | 56289 | 196D226X0035 T | 1 | | |
| C6,C8, C9,C26, C121, C133, C176 | Cap, fxd, cer, 0.01 uF ±20%, 100V | 149153 | 56289 | C023B101F103 M | 7 | | |
| C7, C200 | Cap, fxd, mica, 22 pF ±5%, 500V | 148551 | 71236 | DM15C220J | 2 | | |
| C10, C124 | Cap, fxd, mica, 150 pF ±5%, 500V | 148478 | 71236 | DM15F151J | 2 | | |
| C11, C12, C84 thru C87 | Cap, fxd, Ta, 22 uF ±20%, 20V | 357780 | 56289 | 196D226X0020 P | 6 | | |
| C13 | Cap, fxd, mica, 8 pF ±10%, 500V | 216986 | 71236 | DM15C080K | 1 | | |
| C14 | Cap var, poly propyl, 2 - 22 pF | 369207 | 80031 | C010KA/20E | 1 | | |
| C15, C79, C123 | Cap, fxd, mica, 100 pF ±5%, 500V | 148494 | 71236 | DM15F101J | 3 | | |
| C27 | Cap, fxd, plstc, 0.01 uF ±10%, 50V | 309906 | 06001 | 75F1R4A001 | 1 | | |
| C41 | Cap, fxd, plstc, 0.0039 uF ±10%, 50V | 386847 | 06001 | 75F1R5A392 | 1 | | |
| C46 | Cap, fxd, Ta, 6.8 uF ±20%, 35V | 363713 | 56289 | 196D685X0035 K | 1 | | |
| C64, C65, C156 | Cap, fxd, cer, 0.05 uF ±20%, 100V | 149161 | 56289 | 55C23A1 | 3 | | |
| C67 | Cap, fxd, mica, 56 pF ±5%, 500V | 148528 | 71236 | DM15E560J | 1 | | |
| C70, C71 | Cap, fxd, elect, 470 uF −10/+50% 40V | 185868 | 73445 | ET471X040A02 | 2 | 1 | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| C72, C83 | Cap, fxd, cer, 2000 pF ± gmv, 11KV | 105569 | 71590 | DA140-139CB | 2 | | |
| C73 | Cap, fxd, mica, 30 pF ±5%, 500V | 340570 | 71236 | DM15E300J | 1 | | |
| C75 | Cap, fxd, Ta, 1uF ±20%, 35V | 161919 | 56289 | 196D105X0035 | 1 | | |
| C91 | Cap, fxd, cer, 1pF ±20%, 4000V | 393892 | 32897 | 858-000-C0K10 9M | 1 | | |
| C92 | Cap, fxd, plstc, 0.22 uF ±10%, 50V | 271874 | 06001 | 75F4R5A224 | 1 | | |
| C94 | Cap, fxd, Ta, 15 uF ±20%, 6V | 161935 | 56289 | 196D156X0006 | 1 | | |
| C105, C106 | Cap, fxd, mica, 360 pF ±1%, 500V | 170407 | 71236 | DM15F361F | 2 | | |
| C128, C161 | Cap, fxd, cer, 0.1 uF ±20%, 100V | 149146 | 56289 | 33C41B6 | 2 | | |
| C132 | Cap, fxd, mica, 5.6 pF ±5%, 500V | 329631 | 71236 | DM15C560J | 1 | | |
| C135 | Cap, fxd, Ta, 4.7 uF ±20%, 25V | 161943 | 56289 | 196D475X0025 J | 1 | | |
| C145, C146 | Cap, fxd, mica, 33 pF ±5%, 500V | 160317 | 71236 | DM15E330J | 2 | | |
| C148 | Cap, fxd, mica, 480 pF ±1%, 500V | 182931 | 71236 | DM19E481F | 1 | | |
| C155 | Cap, fxd, mica, 2200 pF ±5%, 500V | 148346 | 71236 | DM19F222J | 1 | | |
| C157 | Cap, fxd, mica, 27 pF ±5%, 500V | 177998 | 71236 | DM15E270J | 1 | | |
| C159 | Cap, fxd, mica, 4700 pF ±5%, 500V | 208975 | 71236 | DM19F472J | 1 | | |
| C174, C185 | Cap, fxd, cer, 0.1 uF −20/+80% 500V | 105684 | 56289 | 41C92 | 2 | | |
| C175 | Cap, fxd, elect, 50 uF −10/+75%, 50V | 105122 | 56289 | 30D505G050BC | 1 | 1 | |
| C180, C193 | Cap, fxd, MTL Polyester, 0.01 uF ±20%, 4KV | 403048 | 84411 | X663F010204K V | 2 | | |
| C181 | Cap, fxd, cer, 100 pF ±20%, 2KV | 306357 | 04222 | HVD4-100202K V1 | 1 | | |
| C182, C183 | Cap, elect, 220 uF −10/+50%, 40V | 178616 | 73445 | ET221X040A01 | 2 | 1 | |
| C192 | Cap, fxd, ceram, 47 pF ±10%, 2KV | 282145 | 04222 | HVD3-47102KV | 1 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| CR35, CR36, CR53, CR54, CR103 thru CR106, CR125, CR126, CR132, CR151, CR152, CR157, CR183, CR185, CR192, CR202 thru CR209 | Diode, Hi-Speed, Switching | 203323 | 07910 | 1N448 | 25 | 5 | |
| CR70, CR175, CR182 | Diode, Rectifier Bridge | 296509 | 09423 | FB200 | 3 | 1 | |
| CR92, CR121 thru CR124, CR154, CR155 | Diode, Si, Low Cap | 375907 | 07263 | FD7222 | 7 | 2 | |
| CR101, CR102 | Diode, Si, Schottky Barrier Switching | 313247 | 51174 | HP5082-6264 | 2 | 1 | |
| J24, J25, J26 | Conn, Coax | 394239 | 98291 | 51-151-0000 | 3 | | |
| L11, L12, L85, L86 | Choke, 6 Turn | 320911 | 89536 | 320911 | 4 | | |
| Q7, Q121 | Xstr, FET, D-MOS, N-Channel | 394122 | 18324 | SD210 | 2 | 1 | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| Q37, Q42, Q44, Q45, Q77, Q101, Q102, Q103, Q106, Q147 | Xstr, Si, PNP | 195974 | 04713 | 2N3906 | 10 | 2 | |
| Q40, Q51, Q92, Q93, Q105, Q138, Q161, Q176, Q183, Q184, Q185 | Xstr, Si, NPN | 218396 | 04713 | 2N3904 | 11 | 3 | |
| Q43 | Xstr, Si, NPN | 329698 | 07263 | 2N2484 | 1 | 1 | |
| Q62 | Xstr, Si, NPN | 203489 | 07910 | CDQ10656 | 1 | 1 | |
| Q76 | Xstr, Si, PNP, Power | 325753 | 03508 | D45C5 | 1 | 1 | |
| Q79 | Xstr, Si, NPN, Power | 325761 | 03508 | D44C5 | 1 | 1 | |
| Q104 | Xstr, Si, NPN | 295717 | 24355 | 00117 | 1 | 1 | |
| Q128 | Xstr, FET, Junction, N-Channel | 288324 | 12040 | SF50070 | 1 | 1 | |
| Q132 | Xstr, Si, PNP | 229898 | 04713 | MPS6522 | 1 | 1 | |
| Q140 | Xstr, Si, NPN | 333898 | 04713 | MPSH10 | 1 | 1 | |
| Q148 | Xstr, Si, PNP | 392985 | 07263 | 2N3931 | 1 | 1 | |
| Q177, Q182, Q186, Q187 | Xstr, Si, NPN | 346916 | 07263 | 2N2219A | 4 | 1 | |
| R1, R2 | Res, fxd, comp, 750 ±5%, ¼W | 218024 | 01121 | CB7515 | 2 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R3, R41, R44, R92, R97 | Res, fxd, comp, 1.5K ±5%, ¼W | 148031 | 01121 | CB1525 | 5 | | |
| R6 | Res, fxd, met film, 49.9K ±1%, 1/8W | 268821 | 91637 | MFF1-84992F | 1 | | |
| R7 | Res, fxd, met film, 5.23K ±1%, 1/8W | 268821 | 91637 | MFF1-85231F | 1 | | |
| R8 | Res, fxd, met film, 71.5K ±1%, 1/8W | 291435 | 91637 | MFF1-87152F | 1 | | |
| R9, R123 | Res, var, cer, 200K ±10%, ½W | 381921 | 32997 | 3299W-1-204 | 2 | | |
| R11 | Res, fxd, comp, 27K ±5%, ¼W | 148148 | 01121 | CB2735 | 1 | | |
| R12, R83, | Res, fxd, comp, 51K ±5%, ¼W | 193334 | 01121 | CB5135 | 2 | | |
| R14 | Res, fxd, met film, 1K ±1%, 1/8W | 168229 | 91637 | MFF1-81001F | 1 | | |
| R15 | Res, fxd, met film, 2.55K ±1%, 1/8W | 325498 | 91637 | MFF1-82551F | 1 | | |
| R21 | Res, fxd, met film, 14K ±1%, 1/8W | 379057 | 91637 | MFF1-81402F | 1 | | |
| R23 | Res, fxd, met film, 8.06K ±1%, 1/8W | 294942 | 91637 | MFF1-88061F | 1 | | |
| R24 | Res, fxd, met film, 6.98K ±1%, 1/8W | 261685 | 91637 | MFF1-86981F | 1 | | |
| R25 | Res, fxd, met film, 15K ±1%, 1/8W | 328161 | 91637 | MFF1-81502F | 1 | | |
| R26, R197 | Res, fxd, met film, 806 ±1%, 1/8W | 223662 | 91637 | MFF1-88060F | 2 | | |
| R27, R28, R137, R158, R190 | Res, fxd, comp, 1M ±5%, ¼W | 182204 | 01121 | CB1055 | 5 | | |
| R29, R48, R159, R164 | Rex, fxd, comp, 10K ±5%, ¼W | 148106 | 01121 | CB1035 | 4 | | |
| R35, R45 | Rex, fxd, comp, 68K ±5%, ¼W | 148171 | 01121 | CB6835 | 2 | | |
| R36 | Res, fxd, comp, 220K ±5%, ¼W | 160937 | 01121 | CB2245 | 1 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R37, R93, R203 | Res, fxd, comp, 4.7K ±5%, ¼W | 148072 | 01121 | CB4725 | 3 | | |
| R38, R53, R54, R136 | Res, fxd, comp, 220 ±5%, ¼W | 147959 | 01121 | CB2215 | 4 | | |
| R40, R127 | Res, fxd, comp, 47K ±5%, ¼W | 148163 | 01121 | CB4735 | 2 | | |
| R42, R46, R47, R75, R121, R128, R185, R191 | Res, fxd, comp, 100 ±5%, ¼W | 147926 | 01121 | CB1015 | 8 | | |
| R43, R52 | Res, fxd, comp, 22K ±5%, ¼W | 148130 | 01121 | CB2235 | 2 | | |
| R49 | Res, fxd, comp, 2.2K ±5%, ¼W | 148049 | 01121 | CB2225 | 1 | | |
| R50 | Res, fxd, comp, 1.2K ±5%, ¼W | 190371 | 01121 | CB1225 | 1 | | |
| R51 | Res, fxd, comp, 5.6K ±5%, ¼W | 148080 | 01121 | CB5625 | 1 | | |
| R59, R91 | Res, fxd, met film, 9.53M ±1%, 1W | 394098 | 91637 | MFF1-89534F | 2 | | |
| R60 | Res, fxd, comp, 2K ±5%, ½W | 169854 | 01121 | EB2025 | 1 | | |
| R61, R62 | Res, fxd, comp, 1.2K ±5%, 1W | 109892 | 01121 | CB1225 | 2 | | |
| R63, R66 | Res, fxd, met film, 10K ±1%, 1/8W | 168260 | 91637 | MFF1-81002F | 2 | | |
| R64, R65 | Res, fxd, met film, 20K ±1%, 1/8W | 291872 | 91637 | MFF1-82002F | 2 | | |
| R67 | Res, fxd, met film, 56.2K ±1%, 1/8W | 271346 | 91637 | MFF1-85622F | 1 | | |
| R72 | Res, fxd, comp, 120K ±5%, ¼W | 193458 | 01121 | CB1245 | 1 | | |
| R73, R74, R133, R134, R156 | Res, fxd, met film, 7.5K ±1%, 1/8W | 223529 | 91637 | MFF1-87501F | 5 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R76 | Res, fxd, comp, 2K ±5%, ¼W | 202879 | 01121 | CB2025 | 1 | | |
| R77 | Res, fxd, comp, 8.2 ±5%, ¼W | 246751 | 01121 | CB82G5 | 1 | | |
| R78 | Res, fxd, comp, 2.4K ±5%, ¼W | 193433 | 01121 | CB2425 | 1 | | |
| R79 | Res, fxd, comp, 3.9 ±5%, ¼W | 268722 | 01121 | CB39G5 | 1 | | |
| R80 | Res, fxd, met film, 5.11K ±1%, 1/8W | 294868 | 91637 | MFF1-85111F | 1 | | |
| R81 | Res, fxd, met film, 4.22K ±1%, 1/8W | 168245 | 91637 | MFF1-84221F | 1 | | |
| R82, R154 | Res, var, cer, 1K ±10%, ½W | 275750 | 71450 | 360T102A | 2 | | |
| R94, R95, R140, R141, R151 | Res, fxd, comp, 1K ±5%, ¼W | 148023 | 01121 | CB1025 | 5 | | |
| R96, R106, R107, R157 | Res, fxd, met film, 1.5K ±1%, 1/8W | 313098 | 91637 | MFF1-81501F | 4 | | |
| R98 | Res, fxd, comp, 33K ±5%, ¼W | 148155 | 01121 | CB3335 | 1 | | |
| R101, R102, R143, R193 | Res, fxd, met film, 1.82K ±1%, 1/8W | 293670 | 91637 | MFF1-81821F | 4 | | |
| R103 | Res, mxd, met film, 3.01K ±1%, 1/8W | 312645 | 91637 | MFF1-83011F | 1 | | |
| R104, R105 | Res, fxd, met film, 40.2 ±1%, 1/8W | 245373 | 91637 | MFF1-840R2F | 2 | | |
| R108 | Res, fxd, met film, 147 ±1%, 1/8W | 288415 | 91637 | MFF1-81470F | 1 | | |
| R109 | Res, fxd, met film, 267 ±1%, 1/8W | 386821 | 91637 | MFF1-82670F | 1 | | |
| R110 | Res, fxd, met film, 2.37K ±1%, 1/8W | 293720 | 91637 | MFF1-82371F | 1 | | |
| R111 | Res, var, cer, 100 ±10%, ½W | 275735 | 11236 | 360T101AZ | 1 | | |
| R122 | Res, fxd, met film, 150K ±1%, 1/8W | 241083 | 91637 | MFF1-81503F | 1 | | |
| R124 | Res, fxd, met film, 10 ±1%, 1/8W | 268789 | 91637 | MFF1-8A100F | 1 | | |
| R125 | Res, fxd, comp, 5.1K ±5%, ¼W | 193342 | 01121 | CB5125 | 1 | | |
| R126, R129 | Ref, fxd, met film, 1.91K ±1%, 1/8W | 236877 | 91637 | MFF1-81911F | 2 | | |
| R130 | Res, var, cer, 500 ±10%, ½W | 325613 | 11236 | 360T501AZ | 1 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R132 | Res, fxd, comp, 3.9K ±5%, ¼W | 148064 | 01121 | CB3925 | 1 | | |
| R135 | Res, fxd, comp, 1.3K ±5%, ¼W | 234252 | 01121 | CB1325 | 1 | | |
| R138 | Res, fxd met film, 3.74K ±1%, 1/8W | 272096 | 91637 | MFF1-83741F | 1 | | |
| R139 | Res, fxd, comp, 10K ±10%, 1W | 109389 | 01121 | GB1031 | 1 | | |
| R142, R155 | Res, fxd, comp, 15K ±5%, ¼W | 148114 | 01121 | CB1535 | 2 | | |
| R144, R146 | Res, fxd, met film, 8.25K ±1%, 1/8W | 294959 | 91637 | MFF1-88251F | 2 | | |
| R147 | Res, fxd, met film, 100K ±1%, 1/8W | 340166 | 91637 | MFF1-81003F | 1 | | |
| R151 | Res, fxd, comp, 5.6M ±5%, ¼W | 358077 | 01121 | CB5655 | 1 | | |
| R152, R153 | Res, fxd, comp, 1M ±5%, 2W | 268227 | 01121 | HB1011 | 2 | | |
| R160 | Res, fxd, comp, 150K ±5%, ¼W | 182212 | 01121 | CB1545 | 1 | | |
| R161 | Res, fxd, comp, 680 ±5%, ¼W | 148007 | 01121 | CB6815 | 1 | | |
| R162, R177 | Res, fxd, comp, 510 ±5%, ¼W | 218032 | 01121 | CB5115 | 2 | | |
| R163 | Res, fxd, comp, 39 ±5%, ¼W | 193391 | 01121 | CB3905 | 1 | | |
| R165 | Res, fxd, comp, 510 ±5%, ½W | 108951 | 01121 | EB5115 | 1 | | |
| R166 | Res, fxd, comp, 910 ±5%, ¼W | 203851 | 01121 | CB9115 | 1 | | |
| R167 | Res, fxd, met film 590 ±1%, 1/8W | 261883 | 91637 | MFF1-85900F | 1 | | |
| R170 thru R174 | Res, fxd, met film, 200K ±1%, 1W | 387449 | 91637 | MFF1-2003F | 5 | | |
| R175 | Res, fxd, comp, 200 ±5%, 1W | 190603 | 01121 | GB2015 | 1 | | |
| R176 | Res, fxd, comp, 1.5K ±5%, ½W | 266353 | 01121 | EB1525 | 1 | | |
| R178, R179, R184, R186 | Res, fxd, comp, 270 ±5%, ¼W | 160804 | 01121 | CB2715 | 4 | | |
| R180 | Res, fxd, comp, 51 ±5%, ¼W | 221879 | 01121 | CB5105 | 1 | | |
| R181 | Res, fxd, comp, 10 ±5%, ¼W | 147868 | 01121 | CB1035 | 1 | | |
| R182, R183 | Res, fxd, comp, 680K ±10%, 1W | 109694 | 01121 | GB6811 | 2 | | |

Table 5-6. PRE AMP PCB ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART. NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R192 | Rex, fxd, comp, 2.7K ±5%, ½W | 109074 | 01121 | EB2725 | 1 | | |
| R194, R202 | Rex, fxd, met film, 2.43 ±1%, 1/8W | 312637 | 91637 | MFF1-82341F | 2 | | |
| R195 | Res, fxd, met film, 49.9 ±1%, 1/8W | 305896 | 91637 | MFF1-849R9F | 1 | | |
| R196 | Res, fxd, met film, 249 ±1%, 1/8W | 168203 | 91637 | MFF1-82490F | 1 | | |
| R198 | Res, fxd, met film, 121K ±1%, 1/8W | 229396 | 91637 | MFF1-81213F | 1 | | |
| R199 | Res, fxd, comp, 820 ±5%, 1W | 266379 | 01121 | GB8215 | 1 | | |
| R201 | Res, fxd, comp, 620 ±5%, ½W | 108704 | 01121 | EB6215 | 1 | | |
| R204 | Res, fxd, comp, 100K ±5%, 2W | 285056 | 01121 | HB1045 | 1 | | |
| R205, R206, R207 | Res, fxd, comp, 200K ±5%, 2W | 392696 | 01121 | HB2245 | 3 | | |
| R301 | Res, met film, 10K ±1%, ½W | 151274 | 91637 | MFF1-21002F | 1 | | |
| R302 | Res, met film, 1M ±1%, 1W | 177188 | 91637 | MFF11004F | 1 | | |
| R303, R304 | Assy, Resistor, Divider | 401372 | 89536 | 401372 | 1 | 1 | |
| U7 | IC, Op Amp Linear | 329912 | 12040 | LM318H | 1 | 1 | |
| U12 | IC, Op Amp, Fast Setting | 403063 | 24355 | AD509J | 1 | 1 | |
| U51, U52 | Op to, Isolator, Xstr | 387076 | 50579 | ISO-LIT-D74 | 2 | 1 | |
| U62 | Op to, Isolator, Xstr | 380014 | 01295 | TIL116 | 1 | 1 | |
| U64, T65, U167 | IC, Linear, Vol Comparator | 352195 | 12040 | LM311N | 3 | 1 | |
| U75, U157 | IC, Op, Amp | 271502 | 12040 | LM301A | 2 | 1 | |
| U79 | IC, Linear, Vol Regulator | 313106 | 07263 | U5R7723393 | 1 | 1 | |
| U123 | IC, Linear, Op Amp | 418368 | 12040 | LM208A | 1 | 1 | |
| U160 | Op to, Isolator, Xstr | 393900 | 07374 | OPI1078 | 1 | 1 | |
| VR1, VR2, VR199 | Diode, Zener | 277236 | 07910 | 1N752A | 3 | 1 | |

Table 5-6. PRE AMPLIFIER ASSEMBLY (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| VR76 | Diode, zener | 113332 | 07910 | 1N966A | 1 | 1 | |
| VR94 | Diode, zener | 113316 | 07910 | 1N748 | 1 | 1 | |
| VR132 | Diode, zener | 342527 | 07910 | 333719 | 1 | 1 | |
| VR152 | Diode, zener | 353284 | 12969 | UZ8113 | 1 | 1 | |
| VR166, VR202 | Diode, zener | 172148 | 12065 | 1N3496 | 2 | 1 | |
| VR174 | Diode, zener | 358184 | 12969 | UZ8112 | 1 | 1 | |
| VR176 | Diode, zener | 159780 | 07910 | 1N759 | 1 | 1 | |
| VR182 | Diode, zener | 387092 | 07910 | 1N975A | 1 | 1 | |
| VR185 | Diode, zener | 358176 | 12969 | UZ8110 | 1 | 1 | |
| VR193 | Diode, zener | 386839 | 04713 | 1N5388 | 1 | 1 | |
| XU12 | Socket, IC, 8-pin | 408450 | * | A23-2017 | 1 | | |
| | Conn, card edge, modified | 408005 | 00779 | 583694-9 | 3 | | |
| | Heat sink (Q177) | 104646 | 05820 | 207-AB | 1 | | |
| | Heat sink (Q182) | 104562 | 05820 | NF-209 | 1 | | |
| | Heat sink (Q79) | 407890 | 98978 | PA1-1R | 1 | | |
| | Retainer, guide | 339754 | 89536 | 339754 | 3 | | |
| | Spacer, Mtg, xstr | 152207 | 07047 | 10123DAP | 8 | | |
| | **PCB Assembly, Zener String (Figure 8-6b)** | | | | | | |
| VR1 thru VR9 | Diode, zener, uncomp, 50V | 386839 | 04713 | 1N5388B | 9 | 2 | |
| VR10 | Diode, zener, uncomp, 100V | 358176 | 12969 | UZ8110 | 1 | 1 | |
| VR11 | Diode, zener, uncomp, 200V | 358150 | 12969 | UZ8750 | 1 | 1 | |
| * | Manufactured By: | | | | | | |
| | Jermyn<br>712 Montgomery<br>San Francisco, CA 94111 | | | | | | |

## Table 5-7. PCB ASSEMBLY, PRE AMP TUBE ANODE

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, PRE AMP, TUBE ANODE (Figure 8-6c)** | 397281 | 89536 | 397281 | REF | | |
| R1,R2, R3,R4 | Res, fxd, met film 150K ±0.5%, 1W | 393397 | 91637 | MFF1-11503D | 4 | | |
| V1,V2 | Tube, vacumn | 339762 | 06980 | 7034-4X150A | 2 | 2 | |
| XV1, XV2 | Socket, Tube, loctal | 340927 | 13511 | 88-8X | 2 | | |
| | Clamp, cap mtg | 357715 | 56289 | 4586-97B | 2 | | |
| | Cover, driver shield | 349548 | 89536 | 349548 | 1 | | |
| | Plug, probe | 295295 | 98291 | 011-4017 | 1 | | |
| | Retainer, guide | 339754 | 89536 | 339754 | 1 | | |

## Table 5-8. POWER AMPLIFIER ASSEMBLY

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **ASSY; POWER AMP (Figure 5-12)** | 341511 | 89536 | 341511 | 1 | | |
| 1 | PCB Assy, Power Amp, Upper Tube (Refer to Table 5-9) | 336875 | 89536 | 336875 | 1 | | |
| 2 | PCB Assy, Power Amp, Lower Tube (Refer to Table 5-10) | 336800 | 89536 | 336800 | 1 | | |
| 3 | PCB Assy, Power Amp, Lower Tube Screen Regulator (Refer to Table 5-11) | 362137 | 89536 | 362137 | 1 | | |
| 4 | PCB Assy, Power Amp, Tube Mounting (Refer to Table 5-12) | 336834 | 89536 | 336834 | 1 | | |
| 5 | Cable Assy, Power Amp Input | 346551 | 89536 | 346551 | 1 | | |
| | Cable, coax RG188A/U | 190322 | 70903 | 8269 | 6 in. | | |
| | Probe, Teflon, yellow | 295295 | 98291 | 011-4017 | 2 | | |
| 6 | Decal | 360545 | 89536 | 360545 | 1 | | |
| 7 | Insulator | 338608 | 89536 | 338608 | 1 | | |
| 8 | Shield, Front | 336750 | 89536 | 336750 | 1 | | |
| 9 | Shield, Rear | 337428 | 89536 | 337428 | 1 | | |

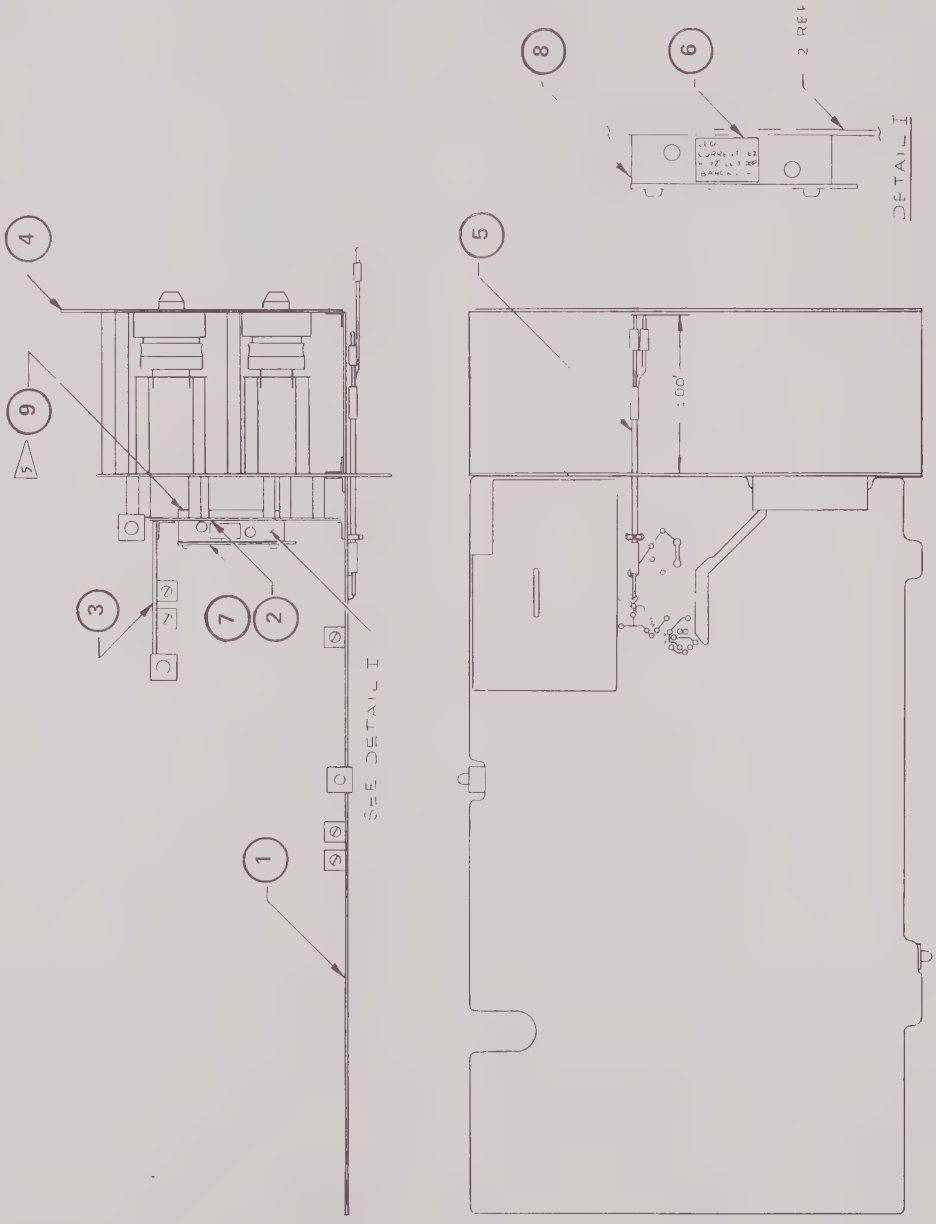



Figure 5-12. POWER AMPLIFIER ASSEMBLY LOCATIONS

Table 5-9. PCB ASSEMBLY, POWER AMP UPPER TUBE

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, POWER AMP, UPPER TUBE (Figure 8-8)** | 336875 | 89536 | 336875 | REF | | |
| C2 | Cap, fxd, mica, 12 pF ±5%, 500V | 175224 | 71236 | DM15C 120J | 1 | | |
| C4 | Cap, fxd, mica, 4pF ±5%, 500V | 190397 | 71236 | DM15C040J | 1 | | |
| C8 | Cap, fxd, cer, 0.05 uF −20/+80%, 25V | 148924 | 72982 | 5855Y5U5032 | 1 | | |
| C10,C11 | Cap, fxd, mica, 510 pF ±5%, 500V | 148411 | 71236 | DM19E511J | 2 | | |
| C25 | Cap, elect, 2200 uF −10/+100%, 25V | 392720 | 99392 | 39CS25HJ252 | 1 | 1 | |
| C26, C41 | Cap, fxd, polyester 0.047 uF ±10%, 250V | 162008 | 73445 | C280MAE/A47K | 2 | | |
| C27 | Cap, fxd, Ta, 6.8 uF ±20%, 35V | 363713 | 56289 | 196D685X0035 | 1 | | |
| C28,C39 | Cap, fxd, plstc, 0.0047 uF ±10%, 50V | 260844 | 06001 | 75F1R5A472 | 2 | | |
| C30,C37 | Cap, fxd, cer, 4700 pF ±10%, 500V | 106724 | 71590 | CF472 | 2 | | |
| C42,C43 | Cap, fxd, elect, 10 uF −10/+50%, 300V | 340885 | 56289 | 500D106F300DC | 2 | 1 | |
| CR1 thru CR4, CR18, CR28, CR29, CR36, CR37 | Diode, Hi-speed switching | 203323 | 07910 | 1N448 | 9 | | |
| CR5, CR7 thru CR10 | Diode, FET, Cur, Reg | 334714 | 07910 | TCR5315 | 5 | 2 | |
| CR6 | Diode, FET, current regulator | 284927 | 01295 | TCR5305 | 1 | 1 | |
| CR25 | Rectifier, bridge | 296509 | 09423 | FB200 | 1 | 1 | |
| CR42, CR43 | Diode, Si, 1 amp | 112383 | 05277 | 1N4822 | 2 | 1 | |
| K1,K2 | Reed, switch | 184440 | 12617 | DRVT-10 | 2 | | |
| | Coil, Reed Relay | 387258 | 71707 | SP24HP | 2 | | |
| | Foil Shield | 336685 | 89536 | 336685 | 2 | | |
| L12 | Choke, 4 turn | 379222 | 89536 | 379222 | 1 | | |
| L14 | Choke, 2 turn | 417196 | 89536 | 417196 | 1 | | |

Table 5-9. PCB ASSEMBLY, POWER AMP UPPER TUBE (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| L17 | Choke, 6 turn | 320911 | 89536 | 320911 | 1 | | |
| P34 | Conn, plug, 15 pin | 310094 | 27264 | 03-09-2151 | 1 | | |
| | Pin, Terminal | 342998 | 27264 | 02-09-2133 | 7 | | |
| Q4 | Xstr, FET, N-channel junction | 387050 | 12040 | SF51108 | 1 | 1 | |
| Q8 | Xstr, Si, NPN | 242065 | 04713 | 2N5089 | 1 | 1 | |
| Q11 | Xstr, Si, NPN, pwr | 343970 | 04713 | MPS-U06 | 1 | 1 | |
| Q12 | Xstr, Si, PNP, pwr | 343988 | 04713 | MPS-U56 | 1 | 1 | |
| Q14 | Xstr, NPN, Hi-voltage | 393926 | 04713 | MM3008 | 1 | 1 | |
| Q16 | Xstr, Si, NPN | 218396 | 04713 | 2N3904 | 1 | 1 | |
| Q17, Q18 | Xstr, Si, PNP | 329607 | 07263 | 2N3964 | 2 | 1 | |
| Q26, Q40 | Xstr, Si, NPN | 218511 | 95303 | 40327 | 2 | 1 | |
| R2 | Res, fxd, comp, 100K ±10%, 1W | 109397 | 01121 | GB1041 | 1 | | |
| R7 | Res, var, cer, 500 ±10%, ½W | 291120 | 71450 | 360S-501A | 1 | 1 | |
| R8 | Res, fxd, comp, 470 ±5%, ¼W | 147983 | 01121 | CB4715 | 1 | | |
| R9 | Res, fxd, comp, 1.5K ±5%, ¼W | 148031 | 01121 | CB1525 | 1 | | |
| R10, R11, R27 | Res, fxd, comp, 100 ±5%, ¼W | 147926 | 01121 | CB1015 | 3 | | |
| R12, R13 | Res, fxd, comp, 10 ±10%, ½W | 108092 | 01121 | EB1001 | 2 | | |
| R14, R15 | Res, fxd, comp, 1.5M ±10%, 1W | 109439 | 01121 | GB1551 | 2 | | |
| R16 | Res, fxd, comp, 10K ±5%, ¼W | 148106 | 01121 | CB1035 | 1 | | |
| R18 | Res, fxd, met film, 137 ±1%, ½W | 151142 | 91637 | MFF1-21370F | 1 | | |
| R19 | Res, fxd, comp, 1M ±10%, 2W | 268227 | 01121 | HB1051 | 1 | | |
| R24, R34 | Res, fxd, met film, 22.6K ±1%, 1/8W | 288431 | 91637 | MFF1-82262F | 2 | | |
| R25, R41 | Res, fxd, comp, 33 ±5%, ¼W | 175034 | 01121 | CB3305 | 2 | | |
| R26, R40 | Res, fxd, comp, 8.2K ±5%, 2W | 330555 | 01121 | HB8225 | 2 | | |

Table 5-9. PCB ASSEMBLY, POWER AMP UPPER TUBE (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R28, R39 | Res. fxd. comp. 5.6K ±5%, ¼W | 148080 | 01121 | CB5625 | 2 | | |
| R29, R36 | Res. fxd. met film, 14.3K ±1%, 1 8W | 291617 | 91637 | MFF1-81432F | 2 | | |
| R30, R37 | Res. fxd. met film, 499K ±1%, ½W | 151332 | 91637 | MFF1-24993F | 2 | | |
| R31, R38 | Res. fxd. ww, pwr 40K ±5%, 10W | 392688 | 91637 | CW104002J | 2 | | |
| R32 | Res. fxd. met film, 1.21K ±1%, 1 8W | 229146 | 91637 | MFF1-81211F | 1 | | |
| R33, R35 | Res. var. cermet, 5K ±10%, ½W | 355503 | 11236 | 360S502AZ | 2 | 1 | |
| R42, R43, R44 | Res. fxd. pwr, 27 ±5%, 3W | 393413 | 91637 | Type FP37 | 3 | | |
| R45 | Res. fxd. comp. 270 ±5%, ¼W | 160804 | 01121 | CB2715 | 1 | | |
| T43 | Xfmr | 401380 | 84536 | 401380 | 1 | | |
| U28, U39 | IC, Op. Amp | 271502 | 12040 | LM301A | 2 | 1 | |
| VR13, VR26, VR41 | Diode, zener | 159798 | 07910 | 1N748 | 3 | 1 | |
| VR14 | Diode, zener | 356995 | 04713 | 1N5335B | 1 | 1 | |
| VR15 | Diode, zener | 355073 | 12969 | UZ5708 | 1 | 1 | |
| VR19 | Diode, zener | 407525 | 12969 | UZ5740 | 1 | 1 | |
| VR33 | Diode, zener | 172145 | 12065 | 1N3496 | 1 | 1 | |
| VR37 thru VR40 | Diode, zener | 355154 | 12969 | UZ5112 | 4 | 1 | |
| XQ17 | Socket, Xstr | 285262 | 71785 | 133-23-92-039 | 1 | | |
| | Guide, retainer | 341099 | 84536 | 341099 | 2 | | |
| | Heat sink (Q4 & Q17) | 354993 | 89473 | TXC20CB | 2 | | |
| | Heat sink (Q14) | 164562 | 05820 | NF-209 | 1 | | |
| | Heat sink (Q11) | 349214 | 89473 | UP-TO126-53CB | 1 | | |
| | Heat sink (Q12) | 407999 | 89473 | PA14R | 1 | | |

Table 5-9. PCB ASSEMBLY, POWER AMP UPPER TUBE (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | Heat sink (Q26 & Q40) | 104646 | 05820 | 207-AB | 2 | | |
| | Jack, Horizontal, conn | 149112 | 74970 | 105-0753 | 4 | | |
| | Safety, guard | 402040 | 89536 | 402040 | 1 | | |
| | Transipad, xstr (Q14, Q26 & Q40) | 152207 | 07047 | 10123DAP | 3 | | |

## Table 5-10. PCB ASSEMBLY, POWER AMP LOWER TUBE

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, POWER AMP LOWER TUBE (Figure 8-10a)** | 341586 | 89536 | 341586 | REF | | |
| C50, C185 | Cap, fxd, plstc, 0.047 uF ±20%, 4KV | 393389 | 56289 | 430P | 2 | | |
| C162 | Cap, var, cer,5 - 50 pF ± 250V | 404301 | 91293 | 9335 | 1 | | |
| C170 | Cap, fxd, mica, 33 pF ±5%, 500V | 160317 | 71236 | DM15E330J | 1 | | |
| C171 | Cap, fxd, Ta, 0.22 uF ±20%, 35V | 161331 | 56289 | 196D224X0035 HA1 | 1 | | |
| C180 | Cap, elect, 220 uF −10/+50%, 40V | 178616 | 73445 | ET221X040A01 | 1 | 1 | |
| C181 | Cap, elect, 1000 uF −10/+100%, 40V | 340901 | 99392 | 39C40HH13 | 1 | 1 | |
| C182, C183 | Cap, fxd, Ta, 6.8 uF ±20%, 35V | 363713 | 56289 | 196D685X0035 HA1 | 2 | | |
| CR158, CR160, CR170 | Diode, Hi-speed switching | 203323 | 07910 | 1N448 | 3 | 1 | |
| CR180 | Rectifier, bridge | 296509 | 09423 | FB200 | 1 | 1 | |
| J32 | Conn, board edge recpt, 6 | 291625 | 00779 | 583650-1 | 1 | | |
| J37 | Conn, board edge recpt, 10 | 403964 | 00779 | 583407-6 | 1 | | |
| L50, L185 | Choke, 4 turn | 379222 | 89536 | 379222 | 2 | | |
| L155 | Inductor, sub-mini | 249078 | 24759 | MR10 | 1 | | |
| L182, L183 | Choke, 6 turn | 320911 | 89536 | 320911 | 2 | | |
| Q150 | Xstr, Si, NPN | 343970 | 04713 | MPS-U06 | 1 | 1 | |
| Q155, Q161 | Xstr, FET, N-Channel | 403089 | 12040 | SF58014 | 2 | 1 | |
| Q158 | Xstr, Si, PNP | 195974 | 04713 | 2N3906 | 1 | 1 | |
| Q160 | Xstr, Si, PNP | 329607 | 07263 | 2N3964 | 1 | 1 | |
| Q165 | Xstr, Si, NPN | 242065 | 04713 | 2N5089 | 1 | 1 | |
| R50, R185 | Res, fxd, comp, 10 ±5%, 1W | 166298 | 01121 | GB1005 | 2 | | |
| R151 | Res, fxd, met film, 10 ±1%, ½W | 151043 | 91637 | MFF1-210R0F | 1 | | |

Table 5-10. PCB ASSEMBLY, POWER AMP LOWER TUBE (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R152 | Res, fxd, comp, 2.7K ±5%, ½W | 109074 | 01121 | DB2725 | 1 | | |
| R155 | Res, fxd, comp, 510 ±5%, 1W | 157578 | 01121 | GB5115 | 1 | | |
| R156 | Res, fxd, comp, 4.3K ±5%, ½W | 403337 | 01121 | DB4325 | 1 | | |
| R157, R174 | Res, fxd, comp, 1K ±5%, ¼W | 148023 | 01121 | CB1025 | 2 | | |
| R158 | Res, fxd, comp, 3.3K ±5%, ¼W | 148056 | 01121 | CB3325 | 1 | | |
| R160 | Res, fxd, met film, 422 ±1%, ½W | 150821 | 91637 | MFF1-24220F | 1 | | |
| R161 | Res, fxd, comp, 39 ±5%, ¼W | 193391 | 01121 | CB3905 | 1 | | |
| R162 | Res, fxd, comp, 5.1K ±5%, ½W | 109108 | 01121 | EB5125 | 1 | | |
| R170 | Res, fxd, met film, 10K ±1%, 1/8W | 168260 | 91637 | MFF1-81002F | 1 | | |
| R171 | Res, fxd, met film, 59K ±1%, 1/8W | 261677 | 91637 | MFF1-85902F | 1 | | |
| R172 | Res, var, cermet, 2K ±10%, ½W | 285163 | 71450 | 360S202A | 1 | | |
| R173 | Res, fxd, met film, 909 ±1%, 1/8W | 312629 | 91637 | MFF1-89090F | 1 | | |
| R175 | Res, fxd, comp, 2.4K ±5%, ½W | 108902 | 01121 | DB2425 | 1 | | |
| U165 | Opto - Coupler | 351734 | 89536 | 351734 | 1 | 1 | |
| U170 | IC, Op Amp | 271502 | 12040 | LM301A | 1 | 1 | |
| VR156 | Diode, zener | 340695 | 12969 | UZ8710 | 1 | 1 | |
| VR159 | Diode, zener | 260695 | 07910 | 1N754 | 1 | 1 | |
| VR161 | Diode, zener | 246611 | 07910 | 1N961B | 1 | 1 | |
| VR175 | Diode, zener | 172148 | 12065 | 1N3496 | 1 | 1 | |
| | Guide | 341099 | 89536 | 341099 | 1 | | |
| | Heat sink (Q150) | 349019 | 98978 | UP-TO126-83CB | 1 | | |

Table 5-11. PCB ASSEMBLY, LOWER TUBE SCREEN REGULATOR

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, LOWER TUBE SCREEN REGULATOR (Figure 8-10b)** | 362137 | 89536 | 362137 | REF | | |
| C101, C102 | Cap, elect, 10 uF −10/+50%, 300V | 340885 | 56289 | 500D106F300DC7 | 2 | 1 | |
| C103, C117 | Cap, fxd, polyester 0.047 uF ±10%, 250V | 162008 | 73445 | C280MAE/A47K | 2 | | |
| C104 | Cap, fxd, Ta, 6.8 uF ±20%, 35V | 363713 | 56289 | 196D685X0035 | 1 | | |
| C105, C114 | Cap, fxd, cer 0.0047 uF ±10%, 1KV | 106724 | 71590 | CF472 | 2 | | |
| C106, C115 | Cap, fxd, plstc, 0.0047 uF ±10%, 50V | 260844 | 06001 | 75F1R5A472 | 2 | | |
| CR101, CR102 | Diode, Si, 2 Amp | 112383 | 05277 | 1N4822 | 2 | 1 | |
| CR104, CR110, CR113, CR114 | Diode, Hi-speed switching | 203323 | 07910 | 1N448 | 4 | 2 | |
| Q101, Q116 | Xstr, Si, NPN | 218511 | 95303 | 65120 | 2 | 1 | |
| R101, R116 | Res, fxd, comp, 8.2K ±5%, 2W | 330555 | 01121 | HB8225 | 2 | | |
| R102, R117 | Res, fxd, comp, 33 ±5%, ¼W | 175034 | 01121 | CB3305 | 2 | | |
| R103 | Res, fxd, comp, 100 ±5%, ¼W | 147926 | 01121 | CB1015 | 1 | | |
| R104, R108 | Res, fxd, pwr, ww, 40K ±5%, 10W | 392688 | 91637 | CW10X000D40R00J | 2 | | |
| R105, R114 | Res, fxd, met film, 499K ±1%, ½W | 151332 | 91637 | MFF1-24993F | 2 | | |
| R106, R115 | Res, fxd, comp, 5.6K ±5%, ¼W | 148080 | 01121 | CB5625 | 2 | | |
| R107 | Res, fxd, met film, 2.26K ±1%, ½W | 262006 | 91637 | MFF1-22261F | 1 | | |
| R109, R112 | Res, var, cermet, 5.0K ±10%, ½W | 355503 | 11236 | 362S502 | 2 | | |
| R110, R113 | Res, fxd, met film, 14.3K ±1%, 1/8W | 291617 | 91637 | MFF1-81432F | 2 | | |

Table 5-11. PCB ASSEMBLY, LOWER TUBE SCREEN REGULATOR (Cont.)

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| R111, R118 | Res, fxd, met film, 22.6K ±1%, 1/8W | 288431 | 91637 | MFF1-82262 | 2 | | |
| U101, U114 | IC, Op Amp | 271502 | 18324 | LM301A | 2 | 1 | |
| VR103, VR117 | Diode, zener | 159798 | 07910 | 1N751A | 2 | 1 | |
| VR105, VR106, VR107, VR108 | Diode, zener | 358184 | 12969 | UZ8112 | 4 | 1 | |
| VR112 | Diode, zener | 172148 | 12065 | 1N3496 | 1 | 1 | |
| | Guide, Retainer | 341099 | 89536 | 341099 | 1 | | |
| | Heat sink | 104646 | 90372 | 207AB | 2 | | |
| | Transipad, xstr | 152207 | 07047 | 10123DAP | 2 | | |

Table 5-12. PCB ASSEMBLY, POWER AMP TUBE MOUNTING

| REF DESIG OR ITEM NO. | DESCRIPTION | FLUKE STOCK NO. | MFG FED SPLY CDE | MFG PART NO. OR TYPE | TOT QTY | REC QTY | USE CDE |
|---|---|---|---|---|---|---|---|
| | **PCB ASSY, POWER AMP TUBE MOUNTING (Figure 8-10c)** | 336834 | 89536 | 336834 | REF | | |
| J38 | Conn, receptacle | 404053 | 00779 | 583694-8 | 1 | | |
| R201, R208, R221, R225, R229, R230 | Res, fxd, comp, 200 ±5%, ½W | 169839 | 01121 | EB2015 | 6 | | |
| R202, R207 | Res, fxd, comp, 47 ±5%, ½W | 159608 | 01121 | EB4705 | 2 | | |
| R203, R206, R231, R232 | Res, fxd, comp, 1.5M ±10%, 1W | 109439 | 01121 | GB1551 | 4 | | |
| R204, R205, R224, R226 | Res, fxd, met film, 10 ±1%, ½W | 151043 | 91637 | MFF1-2A100F | 4 | | |
| R222, R223, R227, R228 | Res, fxd, power, 360 ±5%, 3W | 393405 | 91637 | TYPEFP37 | 4 | | |
| V1,V2, V3,V4 | Tube, vacuum, Tetrode | 339762 | 08594 | 4X150A | 4 | 4 | |
| XV1, XV2, XV3, XV4 | Socket, tube | 340927 | 02660 | 88-8X | 4 | | |
| | Baffle, pwr Amp board | 341727 | 89536 | 341727 | 1 | | |
| | Baffle, pwr Amp | 400796 | 89536 | 400796 | 1 | | |
| | Guide, Retainer | 341099 | 89536 | 341099 | 1 | | |

Section 6

# Option & Accessory Information

## 6-1. INTRODUCTION

6-2. This section of the manual contains information pertaining to the accessories and options available for the 5205A.

## 6-3. ACCESSORY INFORMATION

6-4. A rack mounting kit, Model No. M10-205-600, is available for the 5205A. Instructions for use accompany the kit.

## 6-5. OPTION —07, REAR PANEL OUTPUT

6-6. Option —07 provides a rear panel output connector for use in system applications. The output cable is routed out the rear panel and the hole plug moved from the rear to front panels. The repositioning shortens the length of output cable available from three feet to approximately two feet. Operation of the instrument and all other parts are identical with the Standard front panel output version.

## Section 7

# General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the Lists of Replaceable parts contained in Section 5. The following information is presented in this section: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## Table 7-1. LIST OF ABBREVIATIONS AND SYMBOLS

| | |
|---|---|
| A or amp | ampere |
| ac | alternating current |
| af | audio frequency |
| a/d | analog-to-digital |
| assy | assembly |
| AWG | american wire gauge |
| B | bel |
| bcd | binary coded decimal |
| $^{o}C$ | Celsius |
| cap | capacitor |
| ccw | counterclockwise |
| cer | ceramic |
| cermet | ceramic to metal(seal) |
| ckt | circuit |
| cm | centimeter |
| cmrr | common mode rejection ratio |
| comp | composition |
| cont | continue |
| crt | cathode-ray tube |
| cw | clockwise |
| d/a | digital-to-analog |
| dac | digital-to-analog converter |
| dB | decibel |
| dc | direct current |
| dmm | digital multimeter |
| dvm | digital voltmeter |
| elect | electrolytic |
| ext | external |
| F | farad |
| $^{o}F$ | Fahrenheit |
| FET | Field-effect transistor |
| ff | flip-flop |
| freq | frequency |
| FSN | federal stock number |
| g | gram |
| G | giga ($10^{9}$) |
| gd | guard |
| Ge | germanium |
| GHz | gigahertz |
| gmv | guaranteed minimum value |
| gnd | ground |
| H | henry |
| hd | heavy duty |
| hf | high frequency |
| Hz | hertz |
| IC | integrated circuit |
| if | intermediate frequency |
| in | inch(es) |
| intl | internal |
| I/O | input/output |
| k | kilo ($10^{3}$) |
| kHz | kilohertz |
| kΩ | kilohm(s) |
| kV | kilovolt(s) |
| lf | low frequency |
| LED | light-emitting diode |
| LSB | least significant bit |
| LSD | least significant digit |
| M | mega ($10^{6}$) |
| m | milli ($10^{-3}$) |
| mA | milliampere(s) |
| max | maximum |
| mf | metal film |
| MHz | megahertz |
| min | minimum |
| mm | millimeter |
| ms | millisecond |
| MSB | most significant bit |
| MSD | most significant digit |
| MTBF | mean time between failures |
| MTTR | mean time to repair |
| mV | millivolt(s) |
| mv | multivibrator |
| MΩ | megohm(s) |
| n | nano ($10^{-9}$) |
| na | not applicable |
| NC | normally closed |
| (–) or neg | negative |
| NO | normally open |
| ns | nanosecond |
| opnl ampl | operational amplifier |
| p | pico ($10^{-12}$) |
| para | paragraph |
| pcb | printed circuit board |
| pF | picofarad |
| pn | part number |
| (+) or pos | positive |
| pot | potentiometer |
| p-p | peak-to-peak |
| ppm | parts per million |
| PROM | programmable read-only memory |
| psi | pound-force per square inch |
| RAM | random-access memory |
| rf | radio frequency |
| rms | root mean square |
| ROM | read-only memory |
| s or sec | second (time) |
| scope | oscilloscope |
| SH | shield |
| Si | silicon |
| serno | serial number |
| sr | shift register |
| Ta | tantalum |
| tb | terminal board |
| tc | temperature coefficient or temperature compensating |
| tcxo | temperature compensated crystal oscillator |
| tp | test point |
| u or μ | micro ($10^{-6}$) |
| uhf | ultra high frequency |
| us or μs | microsecond(s) ($10^{-6}$) |
| uut | unit under test |
| V | volt |
| v | voltage |
| var | variable |
| vco | voltage controlled oscillator |
| vhf | very high frequency |
| vlf | very low frequency |
| W | watt(s) |
| ww | wire wound |
| xfmr | transformer |
| xstr | transistor |
| xtal | crystal |
| xtlo | crystal oscillator |
| Ω | ohm(s) |
| μ | micro ($10^{-6}$) |

## Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

## Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onatrio, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Stevens, Arnold Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81439
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

## Table 7-3. FLUKE TECHNICAL SERVICE CENTERS

**John Fluke Mfg. Co., Inc.**
7001 - 220th Ave. S. W.
Mountlake Terrace, WA 98043
Tel: 206-774-2206

**Fluke Western Technical Center**
2020 N. Lincoln St.
Burbank, CA. 91540
Tel: 213-849-4641

**Fluke Western Technical Center**
2359 De La Cruz Blvd.
Santa Clara, CA. 95050
Tel: 408-985-1200

**Fluke Midwestern Technical Center**
10800 Lyndale Ave. So.
Minneapolis, MN 55420
Tel: 612-884-4541

**Fluke Midwestern Tech. Ctr.**
1287 N. Rand Road
Des Plaines, IL 60016
Tel: 312-298-7470

**Fluke Canadian Technical Ctr.**
6427 Northam Drive
Mississauga, Ontario
Tel: 416-678-1500

**Fluke Canadian Technical Centre**
3829 - 12th St. N. E.
Calgary, Alberta T2E 6M5
Tel: 403-261-0780

**Fluke Eastern Tech. Center**
500 Union Blvd.
Totowa, NJ 07512
Tel: 201-742-3215

**Fluke N. E. Tech. Ctr.**
109 Massachusetts Ave.
Lexington, MA 02173
Tel: 617-861-8620

**Fluke Mideastern Tech. Ctr.**
11501 Huff Court
Kensington, MD. 20795
Tel: 301-881-5300

**Fluke S. E. Technical Ctr.**
P.O. Box 6578
940 N. Fern Creek Ave.
Orlando, FL 32803
Tel: 305- 896-2296

**Fluke S. E. Technical Center**
P. O. Box 9619
1310 Beaman Place
Greensboro, NC 27408
Tel: 919-273-1918

**Fluke Southwestern Tech. Ctr.**
1980 S. Quebec St.
Unit 4
Denver, CO 80231
Tel: 303-750-1228

## Table 7-4. INTERNATIONAL SERVICE CENTERS

**Fluke (Nederland) B.V.**
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

**Fluke International Corporation**
Garnet Close
Watford, WD-2 4TT, England
Tel: 0923-33066

**Coasin S. A.**
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

**Elmeasco Instruments Pty Ltd.**
P. O. Box 334
Brookvale, N.S.W.
Australia 2100
Tel: (02 939-7944

**Ambriex S. A.**
Rua Ceara, 104 - 2.° e 3.° Andares
ZC - 29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Rua Tupi, 535
01233 Sao Paulo SP, Brazil
Tel: 52-7806 & 0912

**Proteco Coasin CIA, Ltda.**
Apartado 228A
Quito, Ecuador
Tel: 526759

**M.B. Electronique S. A.**
29, Rue Emile Duclaux
92150, Suresnes, France
Tel: 7723111 (108)

**Gilman & Co., Ltd.**
P. O. Box 56
Hong Kong
Tel: 227011 (14)

**Hinditron Services Pvt Ltd.**
69/ A.L. Jagmohandas Marg.
Bombay - 400 006, India
Tel: 365344

**Berkeh Company Ltd.**
20 Salm Raod, Roosevelt Ave.
Tehran, Iran
Tel: 828294 831564

**R.D.T. Electronics Engineering Ltd.**
46, Sokolov Street
Ramat Hasharon 47235 Isreal
Tel: 483211

**Toyo Trading Company, Ltd.**
P. O. Box 5014
International Tokyo
Tokyo 100-31, Japan
Tel: (03) 279-0771

**Mexitek, S. A.**
Eugenia 408
Department 1
Mexico 12, D.F.
Mexico
Tel: 5360910-5239751

**C. N. Rood N. V.**
13, Cort van der Lindenstraat
P. O. Box 42
Rijswijk ZH 2100
Netherlands
Tel: 070-996360

**Morgenstierne & Co. A/S**
Konghellgate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: 472-356110

**Brixton Trading Company, Inc.**
Suite 36 Metropolitan Bank Bldg.
Ayala Avenue
Makati, Rizal D-708, Phillippines
Tel: 88-27-06, 88-58-90

**Elairco (Pty) Ltd.**
P. O. Box 13091
Benoni 1511
Transvaal
Republic of South Africa
Tel: 54-5513 - 547571

**Coasin C. A.**
Apdo, Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311 - 728662

Table 7-5. SALES REPRESENTATIVES - DOMESTIC

## ALABAMA

**HUNTSVILLE**
BCS Associates, INc.
3322 S. Memorial Parkway
P.O. Box 1273
Tel. (205) 881-6220
Zip 35807

## ALASKA

**ANCHORAGE**
Harry Lang & Associates
1406 W. 47th Ave.
Tel. (907) 279-5741
Zip 99503

## ARIZONA

**PHOENIX**
Barnhill Associates
7319 E. Stetson Dr.
Tel. (602) 947-7841
Scottsdale, AZ 85251

## CALIFORNIA

**LOS ANGELES**
Instrument Specialists, Inc.
2020 N. Lincoln Street
Burbank, CA 91504
Tel. (213) 849-7181

**NEWPORT BEACH**
Instrument Specialists, Inc.
4120 Birch Street
Suite 119
Tel. (714) 752-6200
Zip 92660

**SANTA CLARA**
Instruments Specialists, Inc.
2359 De La Cruz Blvd.
Tel. (408) 244-1505
Zip 95050

## COLORADO

**DENVER**
Barnhill Associates, Inc.
1980 South Quebec St. Unit 4
Tel. (303) 750-1222
Zip 80231

## CONNECTICUT

**HARTFORD**
Instrument Representatives, Inc.
P. O. Box 518
Glastonbury, CT 06033
Tel. (203) 633-0777

## FLORIDA

**ORLANDO**
BCS Associates, Inc.
940 N. Fern Creek Ave.
Tel. (305) 896-4881
Zip 32803

## GEORGIA

**DECATUR**
BCS Associates, Inc.
2522 Tanglewood Road
Tel. (404) 321-0980
Zip 30033

## HAWAII

**HONOLULU**
Industrial Electronics, Inc.
646 Queen Street
P. O. Box 135
Tel. (808)533-6095
Zip 96817

## ILLINOIS

**CHICAGO**
Cozzens & Cudahy, Inc.
1301 N. Rand Road
Des Plaines, IL 60016
Tel. (312) 298-3600

## INDIANA

**INDIANAPOLIS**
Cozzens & Cudahy, Inc.
Port O'Call Executive Ctr.
21 Beachway Drive
Tel:(317) 244-2456
Zip: 46224

## KENTUCKY

**VALLEY STATION**
BCS Associates, Inc.
4506 Freda Way
Tel: (502) 935-9634
Zip: 40272

## MARYLAND

**BALTIMORE**
Electronic Marketing Assoc. Inc.
11501 Huff Court
Kensington, MD 20795
Tel: (301) 881-5300, 744-7700

## MASSACHUSETTS

**BOSTON**
Instrument Representatives, Inc.
109 Massachusetts Ave.
Lexington, MA 02173
Tel. (617) 861-8620

## MICHIGAN

**DETROIT**
WKM Associates, Inc.
345 Girard
Madison Hts, MI, 48071
Tel: (313) 588-2300

## MINNESOTA

**MINNEAPOLIS**
Cozzens & Cudahy, Inc.
10800 Lyndale Ave. S. 55420
Tel: (612) 884-4336

## MISSOURI

**KANSAS CITY**
Cozzens & Cudahy, Inc.
4404 Chouteau Traffic Way
Tel. (816) 454-5836
Zip 64117

**ST. LOUIS**
Cozzens & Cudahy Inc.
P. O. Box 10013
Lambert Field - Zip 63145
Tel: (314) 423-1234

## NEW JERSEY

**NEWARK**
SBM Representatives
1519A Stuyvesant Avenue
Union, NJ 07083
Tel: (201) 687-8737

## NEW MEXICO

**ALBUQUERQUE**
Barnhill Associates
1410 - D Wyoming N. E.
Tel (505) 299-7658
Zip: 87112

## NEW YORK

**NEW YORK**
SBM Representatives
28 Hobby Street
Pleasantville, NY 10570
Tel (914) 769-1811

**ROCHESTER**
SBM Representatives
4515 Culver Road
Tel. (716) 226-1400
Zip 14622

## NORTH CAROLINA

**GREENSBORO**
BCS Associates, Inc.
P.O. Box 9619
1310 Beaman Place
Tel. (919) 273-1918
Zip 27408

## OHIO

**CLEVELAND**
WKM Associates, Inc.
16141 Puritas Ave.
Tel. (216) 267-0445
Zip 44135

**DAYTON**
WKM Associates, Inc.
7913 So. Suburban Road
Tel. (513) 434-7500
Zip: 45459

Table 7-5. SALES REPRESENTATIVES - DOMESTIC (Continued)

## OREGON

**BEAVERTON**
Showalter Instruments, Inc.
3800 S.W. Cedar Hills Blvd.
Suite 160
Tel: (503) 646-5196
Zip 97005

## PENNSYLVANIA

**PHILADELPHIA**
Electronic Marketing Assoc.
210 Goddard Blvd. Ste. 100
King of Prussia, PA
Tel. (215) 248-5050
Zip 19406

**PITTSBURGH**
WKM Associates, Inc.
90 Clairton Blvd.
Tel. (412) 892-2953
Zip 15236

## TEXAS

**DALLAS**
Barnhill Associates
908 Business Parkway
Richardson, TX 75080
Tel. (214) 231-2573

**HOUSTON**
Barnhill Associates
10606 Hempstead Hwy.
Suite 132
Tel. (713) 688-9971
Zip 77092

## VIRGINIA

**WILLIAMSBURG**
BCS Associates
107 Rich Neck Road
Tel. (804) 877-4053
Zip: 23185

## WASHINGTON

**SEATTLE**
Showalter Instruments, Inc.
1521 - 130 N. E.
Bellevue, WA 98005
Tel. (206) 455-4922
(206) 624-4035

## CANADA

### BRITISH COLUMBIA

**NORTH VANCOUVER**
Allan Crawford Associates, Ltd.
116 E. 3rd St. Suite 203
Tel: (604) 980-4831

### ALBERTA

**CALGARY**
Allan Crawford Associates, Ltd.
3829 - 12th St. N. E. T2E 6M5
Tel. (403) 276-9658

### ONTARIO

**MISSISSAUGA**
Allan Crawford Associates, Ltd.
6427 Northern Drive
Tel. (416) 678-1500

**OTTAWA, 3**
Allan Crawford Associates, Ltd.
1299 Richmond Road K2B 7Y4
Tel. (613) 829-9651

### QUEBEC

**LONGUEUIL**
Allan Crawford Associates, Ltd.
1330 Marie Victorian Blvd. East
Longueuil Br. P.Q. J4G 1A2
Tel (514) 670-1212

### NOVA SCOTIA

**DARTMOUTH**
Allan Crawford Associates, Ltd.
St. 201, Townsend Pl.
800 Windmill Rd.
Burnside Industrial Park
Dartmouth, N. S. B3B 1L1
Tel (902) 469-7865

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL

**Argentina**
Coasin S.A.
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

**Austria**
Kontron GmbH & Co. KG.
Ameisgasse 49
1140 - Vienna, Austria
Tel: 09-43222945646

**Australia**
Elmeasco Instruments, Pty Ltd.
P.O. Box 334
Brookvale, N.S.W.
Australia 2100
Tel: (02) 939-7944

**Belgium**
C.N. Rood S.A.
37, Place de Jamblinee de Meux
B-1040 Brussels, Belgium
Tel: 02-27352135

**Brazil**
Ambriex S.A.
Rua Ceara, 104 - 2.°. e 3.° Andares
ZC-29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Ambriex S. A.
Rua Tupi, 535
01233 Sao Paulo SP, Braxil
Tel: 52-7806 & 0912

**Caribbean**
West Indies Sales Co., Ltd.
7360 N. W. 66th St.
Miami, FL 33166
Tel: (305) 592-8188

**Central America**
Intermetra Corp
11 Park Place, Suite 2003
New York, NY 10007
Tel (212) 349-7630, 31, 32

**Chile**
Coasin Chile Ltd.
Casilla 14588 - Correo 15
Santiago, Chile
Tel: 396713

**China**
May Lee Industries, Inc.
111 Broadway, Suite 510
New York, NY 10006
Tel: (212) 349-5780

**Columbia**
Asistec Limitada
Apartado Aereo 12322
Bogota 1, Colombia
Tel: 419331

**Cyprus**
Chris Radiovision Ltd.
P. O. Box 1989
Nicosia, Cyprus
Tel: 66121

**Denmark**
Tage Olsen A/S
Teglvaerksgade 37
DK-2100 Copenhagen 0
Denmark
Tel: 01-294800

**Eastern Europe Countries**
Elpro GmbH
Molkergasse 4
1080 - Vienna, Austria
Tel: 222 424692

**Ecuador**
Proteco Coasin CIA, Ltda.
Apartado 228A
Quito, Ecuador
Tel: 526759

**Egypt**
Lotus Engineering Organisation
P. O. Box 1252
Cairo, Egypt
Tel: 71617

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL (Continued)

**Finland**
OY Findip AB
Teollisuustie 7
02700 Kaunianen
Finland
Tel: 502255

**France**
M.B. Electronique S.A.
29,Rue Emile Duclaux
92150, Suresnes France
Tel: 7723411 (108)

**Germany**
Fluke (Deutschland) GmbH
4-Dusseldorf
Meineckestrasse 53
West Germany
Tel: 450831

**Greece**
Hellenic Scientific Representations Ltd.
10, Nympheau Street
Athens 615 Greece
Tel: 7792320/705960

**Hong Kong & Macao**
Gilman & Co., Ltd.
P.O. Box 56
Hong Kong
Tel: 227011 (14)

**India**
Hinditron Services Pvt. Ltd.
69/A. L. Jagmohandas Marg
Bombay - 400 006, India
Tel: 365344

**Indonesia**
P.T. United Dico-Citas Co., Ltd.
JLN Penjaringan 39A
Jakarta, Indonesia

**Iran**
Berkeh Company Ltd.
20 Salm Road. Roosevelt Ave.
Tehran, Iran
Tel: 828294 831564

**Isreal**
R.D.T. Electronics Engineering Ltd.
46, Sokolov St
Ramat Hasharon 47235 Isreal
Tel: 483211

**Italy**
Sistrel, S. p.A.
Via Giorgio da Sebenico 11-13
00143 Roma, Italy
Tel: 06-500-1860

**Japan**
Toyo Trading Company, Ltd.
P.O. Box 5014
International Tokyo
Tokyo 100-31, Japan
Tel: (03) 279-0771

Toyo Trading Company, Ltd.
Suzuki Bldg.
2-38 Junkeicho-dori
Minami-ku, Osaka, Japan
Tel: (06) 262-3471

**Kenya**
Advanced Communications, Ltd.
City House, Wabera Street
P.O. Box 30635
Nairobi, Kenya
Tel: 31955

**Korea**
Asia Science & Co.
International P. O. Box 1250
Seoul, Korea
Tel: 76-2761

**Kuwait**
Tareq Company
P.O. Box Safat 20506
Kuwait, Arabian Gulf
Tel: 436100, 436045

**Lebanon**
General Marketing Trading &
Contracting Company
Anis Nsouli Street
Nsouli Building
P.O. Box 155.655
Beirut, LEbanon
Tel: 319383, 312061

**Malaysia**
O'Connor's (PTE) Limited
P.O. Box 91
Petaling Jaya, Selangor
West Malaysia
Tel: 51563

**Mexico**
Mexitek, S.A.
Eugenia 408
Department 1
Mexico 12, D.F.
Mexico
Tel: 5360910 - 5239751

**Morocco**
S.I.E.E.M.
Residence Moulay Ismail
Bat. C.
Boulevard Moulay Slimane
Rabat, Morocco
Tel: 276-64

**Netherlands**
C N. Rood B.V.
13, Cort van der Lindenstraat
P.O. Box 42
Rijswijk ZH 2100
Netherlands
Tel: 070-996360

Fluke (Nederland) B.V.
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

**New Zealand**
Elmeasco Instruments Pty Ltd.
P.O. Box 30515
LOWER HUTT
New Zealand
Tel: 697566

**Nigeria**
Deemtee Electrotechnics, Ltd.
P.O. Box 3073
Lagos, Nigeria

**Norway**
Morgenstierne & Co. A/S
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: (02) 372940

**Pakistan**
Pak International Operations
505 Muhammadi House - McLeod Rd.
P.O. Box 5323
Karachi, Pakistan

**Peru**
Importaciones Y Representaciones
Electronicas S. A.
Avda, Franklin D. Roosevelt 105
Lima 1, Peru
Tel: 27-2078

**Phillippines**
Brixton Trading Company, Inc.
Suite 636 Metropolitan Bank Bldg.
Ayala Avenue
Makati, Rizal D-708, Phillippines
Tel: 88-27-06, 88-58-90

**Portugal**
Equipamentos De Laboratorio Lda.
P.O. Box 1100
Lisbon 1, Portugal
Tel: 976551

**Singapore**
O'Connor's (PTE) Limited
98 Pasir Panjang Road
Singapore 5, Singapore
Tel: 637944

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL (Continued)

**South Africa**
Elairco (Pty) Ltd.
P.O. Box 13091
Benoni 1511
Transvaal
Republic of South Africa
Tel: 54-5513 - 547571

**Spain**
Ataio Ingenieros S. A.
Enrique Larreta 12
Madrid 16, Spain
Tel: 7330562

**Sweden**
Teleinstrument AB
P.O. Box 490
Maltesholmvagen 490
S-162 04 Vallingby
Sweden
Tel: 08-380379

**Switzerland**
Kontron Electronic A.G.
Bernerstrasse-Sub 169
8048 Zurich, **Switzerland**
**Tel**:01-628282

**Taiwan**
Heighten Trading Co, Ltd.
P.O. Box 1408
Taipei, Taiwan 100
Republic of China
Tel: 5118324 - 5118372

**Thailand**
Dynamic Supply Engineering R.O.P.
No. 56 Ekamai, Sukhumvit 63
Bangkok 11, Thailand
Tel: 914434, 928532

**Turkey**
M. Suheyl Erkman
Necatibey Cad. 92/2
Karakoy/Istanbul
Turkey
Tel: 441546 - 447651

**The United Kingdom**
Fluke International Corporation
Garnet Close
Watford, WD 2 4 TT
England
Tel: 0923-33066

**U. S. S. R.**
Codevintec Pacific Inc.
6263 Variel
Woodland Hills, CA 91364
Tel: (213) 348-1719

**Uruguay**
Coasin,Uruguaya S. R. L.
Cerrito 617 - 4° Piso
Montevideo, Uruguay

**Venezuela**
Coasin C. A.
Apdo, Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311 - 728662

*In Europe, contact FLUKE NEDERLAND, B.V., P.O. Box 5053, Industrieterrein Noord, Tilburg, The Netherlands.....*

FLUKE REGIONAL SERVICE CENTER: The NETHERLANDS
FLUKE (NEDERLAND) B.V.
P.O. BOX 5053
TILBURG, THE NETHERLANDS

FLUKE REGIONAL SERVICE CENTER, UNITED KINGDOM
FLUKE INTERNATIONAL CORP.
GARNETT CLOSE
WATFORD, WD24TT ENGLAND.

AUTHORIZED SERVICE LABORATORIES INTERNATIONAL

EACH INTERNATIONAL REPRESENTATIVE IS EQUIPPED WITH AN AUTHORIZED SERVICE LABORATORY, PLEASE REFER TO THE INTERNATIONAL REPRESENTATIVE LISTING FOR YOUR SERVICE NEEDS.

# Section 8
# Schematic Diagrams

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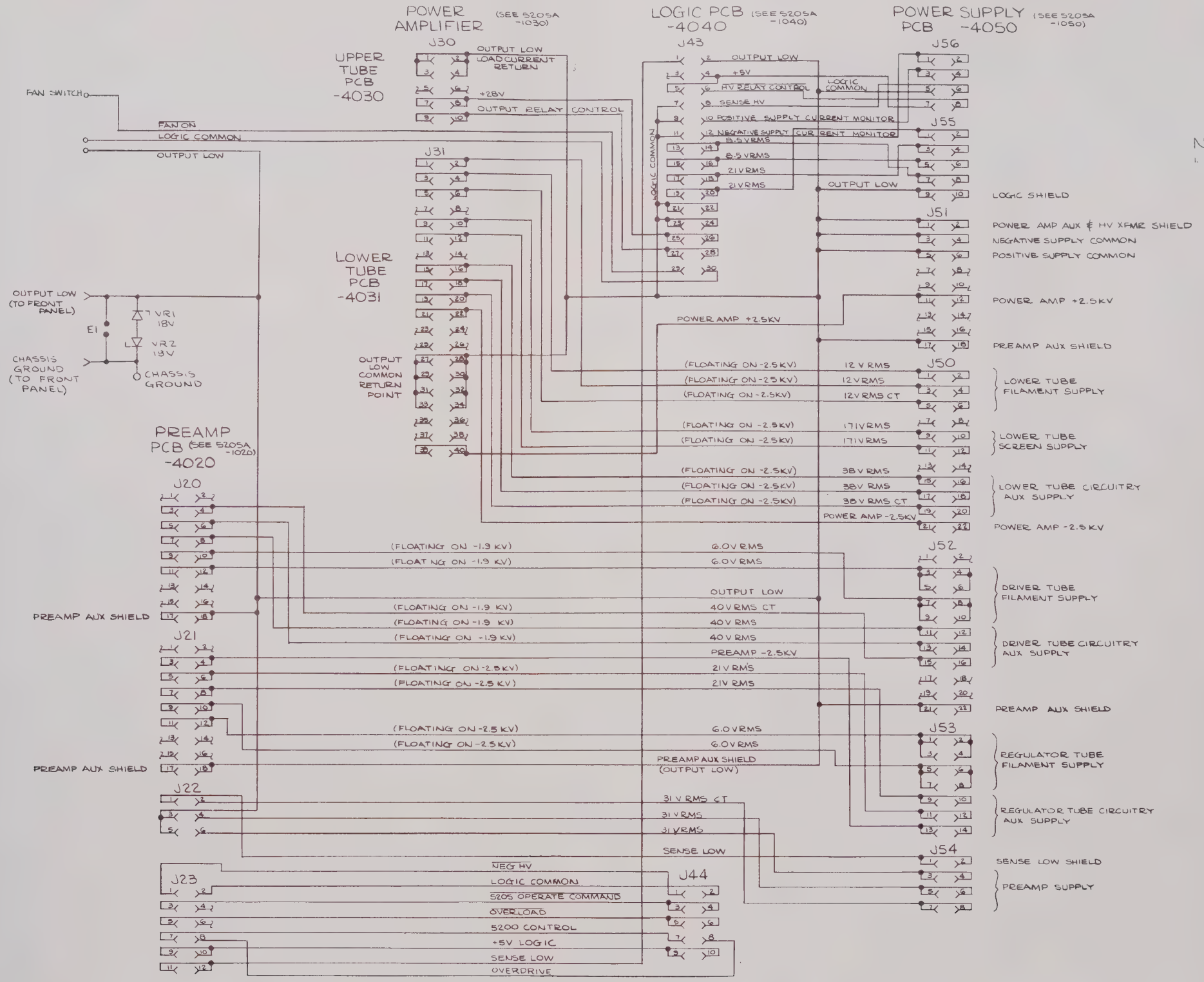
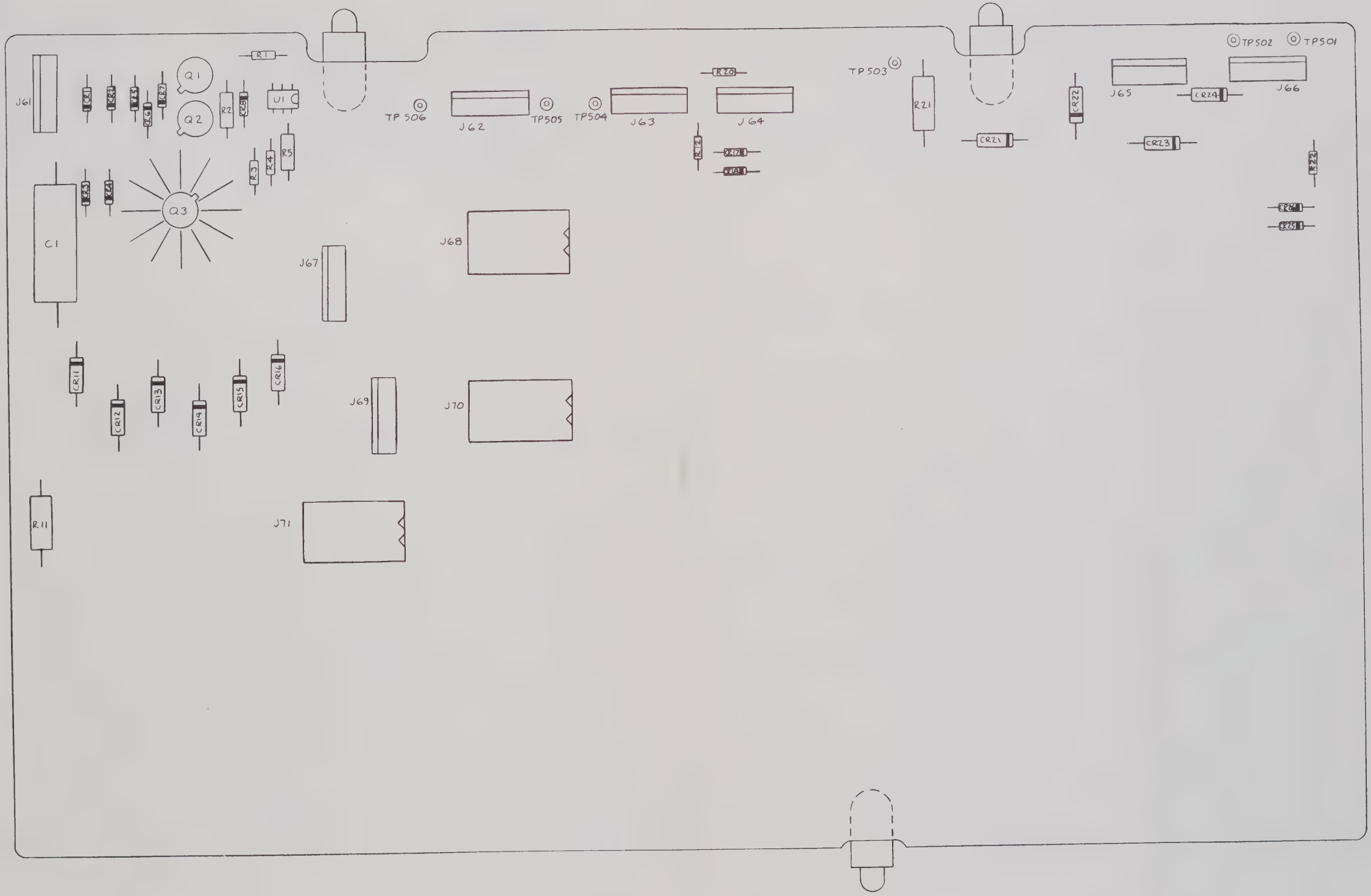



**FIGURE 8-1. MOTHER PCB ASSEMBLY (5205A-1010)**




1. SEE 5205A-1050 FOR SCHEMATIC.

FIGURE 8-2. POWER SUPPLY ASSEMBLY COMPONENT LOCATION

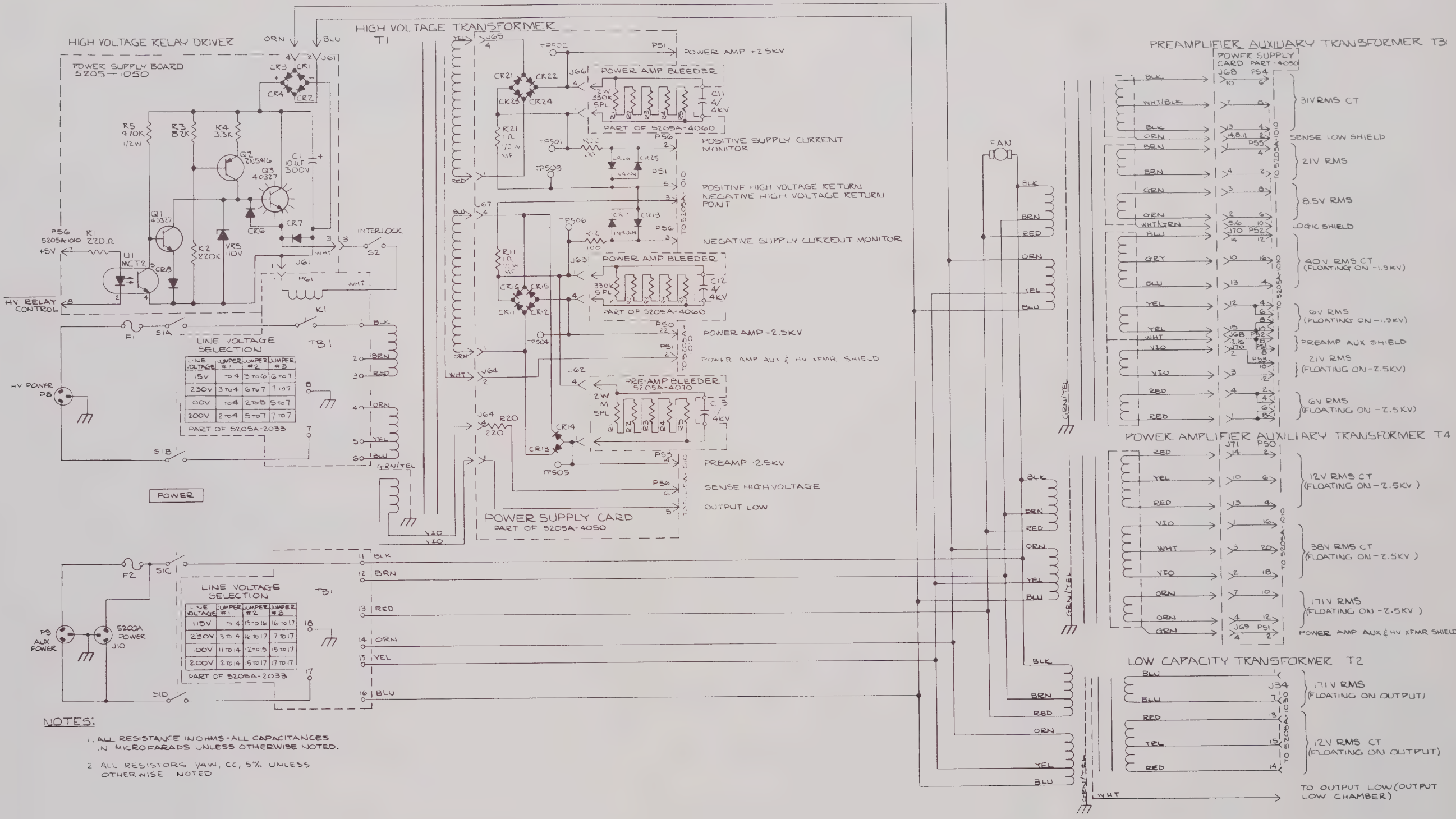
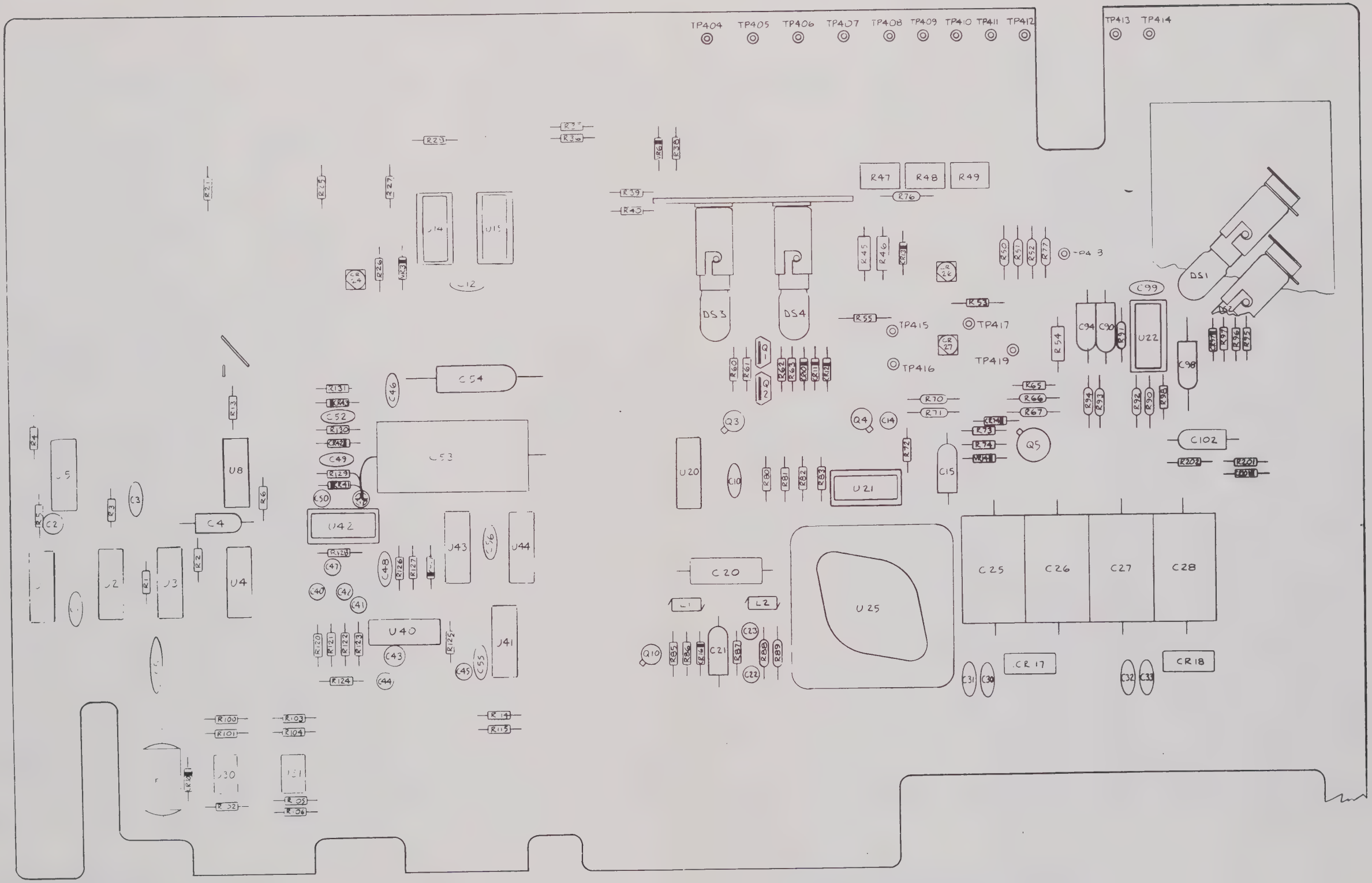
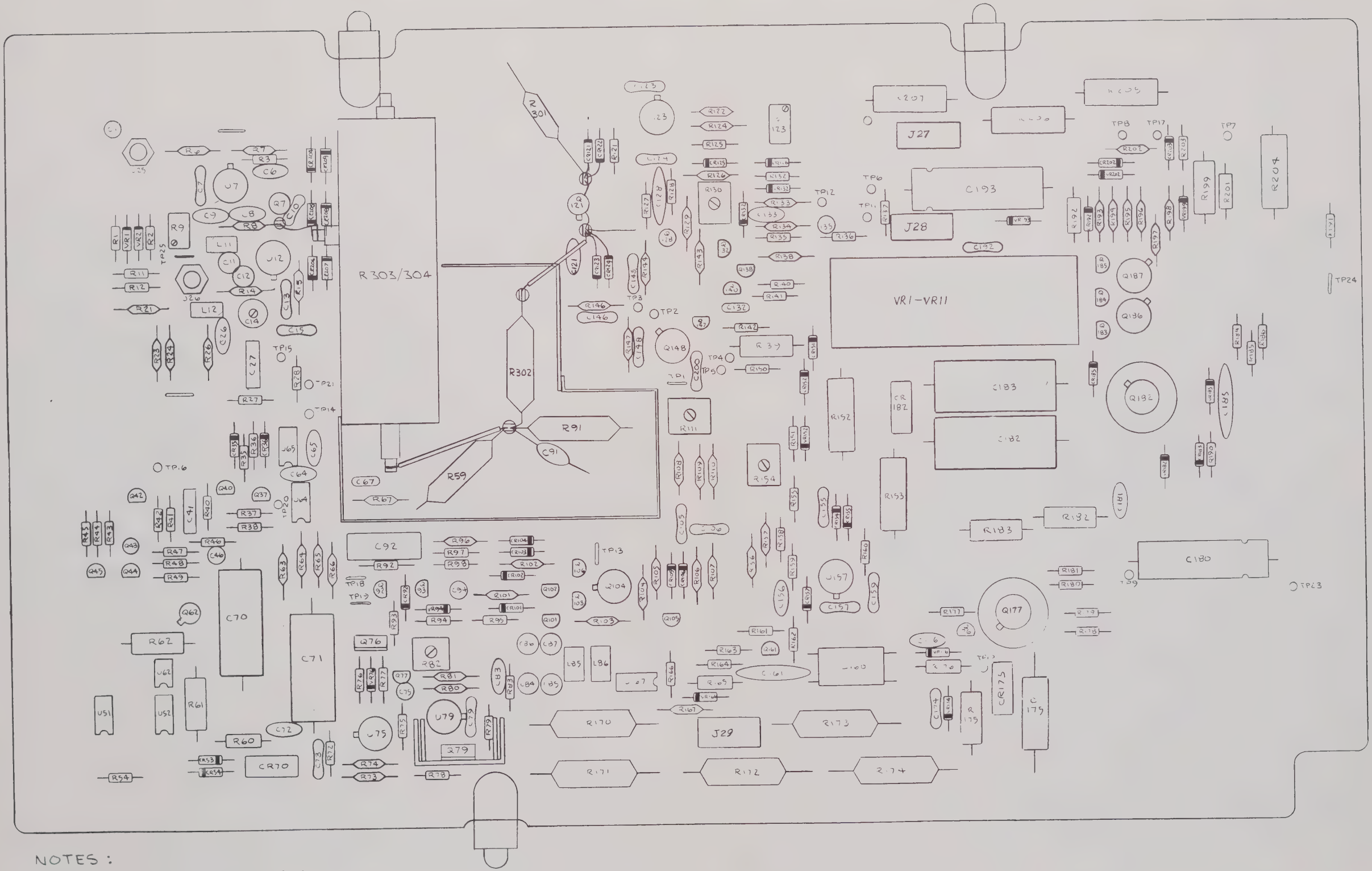

HIGH VOLTAGE RELAY DRIVER
POWER SUPPLY BOARD 5205-1050
HIGH VOLTAGE TRANSFORMER T1
PREAMPLIFIER AUXILIARY TRANSFORMER T3
POWER SUPPLY CARD PART-4050
POWER AMP +2.5KV
POWER AMP BLEEDER
PART OF 5205A-4060
POSITIVE SUPPLY CURRENT MONITOR
POSITIVE HIGH VOLTAGE RETURN
NEGATIVE HIGH VOLTAGE RETURN POINT
NEGATIVE SUPPLY CURRENT MONITOR
POWER AMP -2.5KV
POWER AMP AUX & HV XFMR SHIELD
PRE-AMP BLEEDER 5205A-4070
PREAMP -2.5KV
SENSE HIGH VOLTAGE
OUTPUT LOW
FAN
LINE VOLTAGE SELECTION
PART OF 5205A-2033
POWER
HV POWER
AUX POWER
5200A POWER
31V RMS CT
SENSE LOW SHIELD
21V RMS
8.5V RMS
LOGIC SHIELD
40V RMS CT (FLOATING ON -1.9KV)
6V RMS (FLOATING ON -1.9KV)
PREAMP AUX SHIELD
21V RMS (FLOATING ON -2.5KV)
6V RMS (FLOATING ON -2.5KV)
POWER AMPLIFIER AUXILIARY TRANSFORMER T4
12V RMS CT (FLOATING ON -2.5KV)
38V RMS CT (FLOATING ON -2.5KV)
171V RMS (FLOATING ON -2.5KV)
POWER AMP AUX & HV XFMR SHIELD
LOW CAPACITY TRANSFORMER T2
171V RMS (FLOATING ON OUTPUT)
12V RMS CT (FLOATING ON OUTPUT)
TO OUTPUT LOW (OUTPUT LOW CHAMBER)
NOTES:
1. ALL RESISTANCE IN OHMS - ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE NOTED.
2 ALL RESISTORS 1/4W, CC, 5% UNLESS OTHERWISE NOTED

**FIGURE 8-3. POWER SUPPLY ASSEMBLY (5205A-1050)**


TP404
TP405
TP406
TP407
TP408
TP409
TP410
TP411
TP412
TP413
TP414
R47
R48
R49
R76
DS3
DS4
DS1
DS2
TP415
TP417
TP416
TP419
C99
C94
C90
U22
C98
C102
R54
R55
R53
R65
R66
R67
R70
R71
R74
Q3
Q4
Q5
C14
C15
U20
U21
C10
C20
L1
L2
U25
C25
C26
C27
C28
CR17
CR18
C31
C30
C32
C33
Q10
C21
C22
C23
C54
C46
C52
C53
C49
C50
C51
U42
C4
U8
U5
U2
U3
U4
C47
C48
C40
C41
U40
C43
C44
C45
C55
C56
U43
U44
U41
U30
U31
R100
R101
R103
R104
R105
R106
R114
R115
R132
R133
R134
R135
R136
R137
R138
R139
R140
R141
R142
R143
R144
R145
R146
R147
R148
R149
R150
R151
R152
R153
R154
R155
R156
R157
R158
R159
R160
R161
R162
R163
R164
R165
R166
R167
R168
R169
R170
R171

NOTES:
1. ALL RESISTOR VALUES IN OHMS, ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE NOTED
2. ALL RESISTORS 1/4W, CC, 5% UNLESS OTHERWISE NOTED

FIGURE 8-5. LOGIC PCB ASSEMBLY (5215A-1040)




NOTES:

1. SEE 5215A-1040 FOR SCHEMATIC
2. SEE 5215A-4040 FOR ASSEMBLY

**FIGURE 8-6. PREAMPLIFIER ASSEMBLY COMPONENT LOCATIONS**

SIGNAL AMP

5200 DIVIDER & BUFFER

TEMP. COMP & GATE DRIVE

SLEW RATE SENSOR

LOGIC CONTROL

±15V POWER SUPPLY

900V REGULATOR

5205A-4021 ZENER BOARD

5200A SIGNAL INPUT FROM PS-9
5200A SIGNAL INPUT COM FROM PS-8
5205A SENSE HIGH CABLE FROM 5205A-1030
SENSE OUTPUT TO 5200 FROM PS-24
SENSE OUTPUT COMMON FROM PS-23
NEUT GATE
SENSE LOW
OVERLOAD
5V LOGIC RETURN
+5V LOGIC
5205 OPERATE COMMAND
NEG H.V.
OVERDRIVE
31 V RMS CT
PREAMP SHIELD (SENSE LOW)
40V RMS CT
21V RMS
6.0V RMS
34 PREAMP -2.5KV
17,18 OUT PUT LOW

PREAMP OUTPUT TO POWER AMP 5205A-1030

P20 TO 5205A-1010 11,12 9,10 6.0VRMS

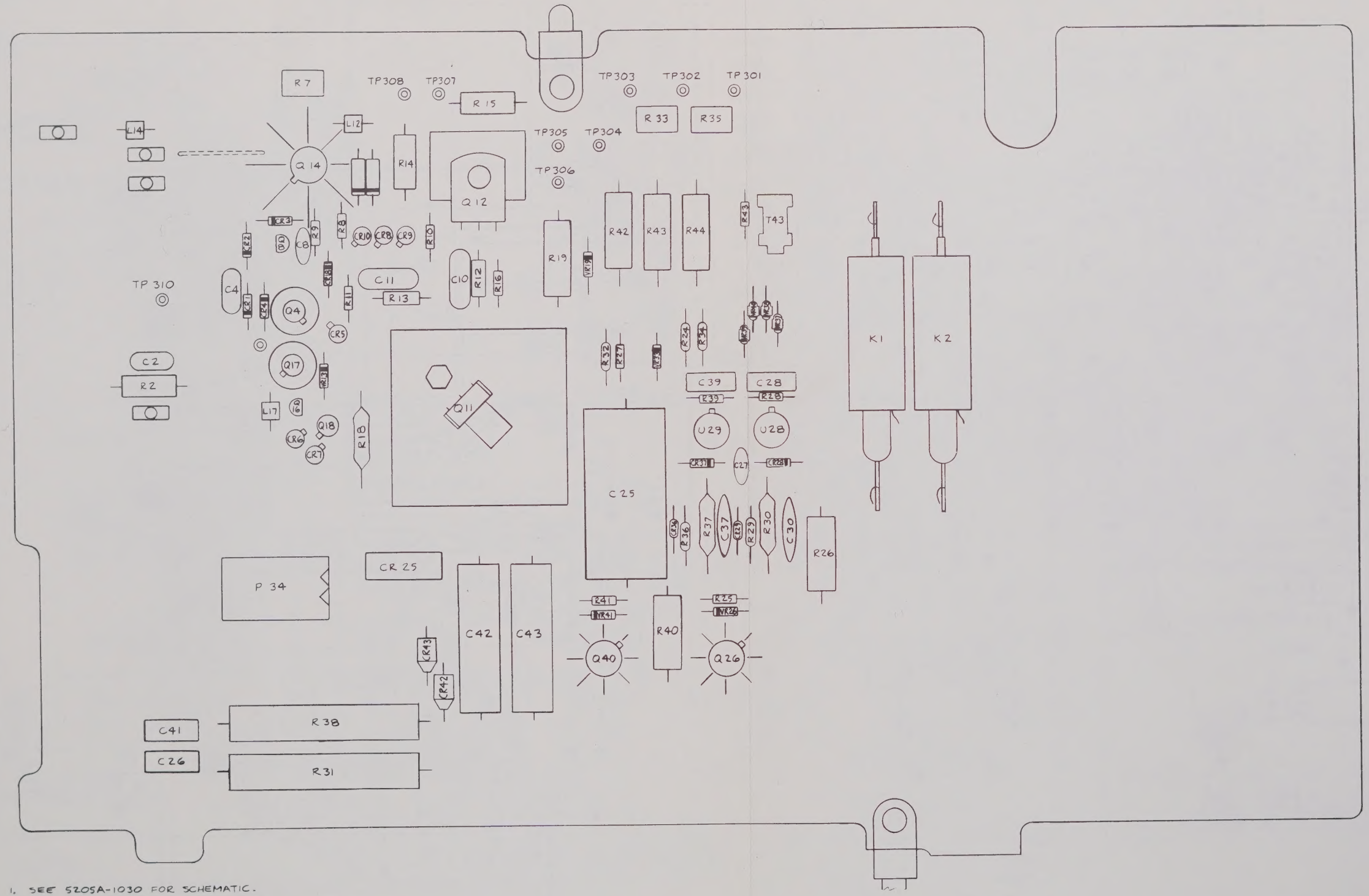
PIN
1 - SCR
3 - FIL
CTR PIN - GR
6 - CA
7 - FIL

NOTED

1. ALL RESISTOR VALUES IN OHMS, ALL CAP VALUES IN MICROFARADS UNLESS OTHERWISE NOTED

3. ALL RESISTORS 1/4W C.C. 5% UNLESS OTHERWISE NOTED.

FIGURE 8-7. PREAMPLIFIER ASSEMBLY (5215A-1020)




1. SEE 5205A-1030 FOR SCHEMATIC.

FIGURE 8-8. POWER AMP UPPER TUBE ASSEMBLY COMPONENT LOCATION

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